US006592466B2

(12) United States Patent
Helmstetter et al.

(10) Patent No.: US 6,592,466 B2
(45) Date of Patent: *Jul. 15, 2003

(54) SOUND ENHANCE COMPOSITE GOLF CLUB HEAD

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/064,168**

(22) Filed: **Jun. 17, 2002**

(65) **Prior Publication Data**

US 2002/0183136 A1 Dec. 5, 2002

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/474,697, filed on Dec. 29, 1999, now Pat. No. 6,406,378, which is a continuation-in-part of application No. 08/958,723, filed on Oct. 23, 1997, now Pat. No. 6,010,411.

(51) **Int. Cl.**[7] **A63B 53/04**

(52) **U.S. Cl.** **473/224**; 473/345; 473/348

(58) **Field of Search** 473/224, 219, 473/335, 336, 345, 346, 347, 348, 349, 305, 311, 327

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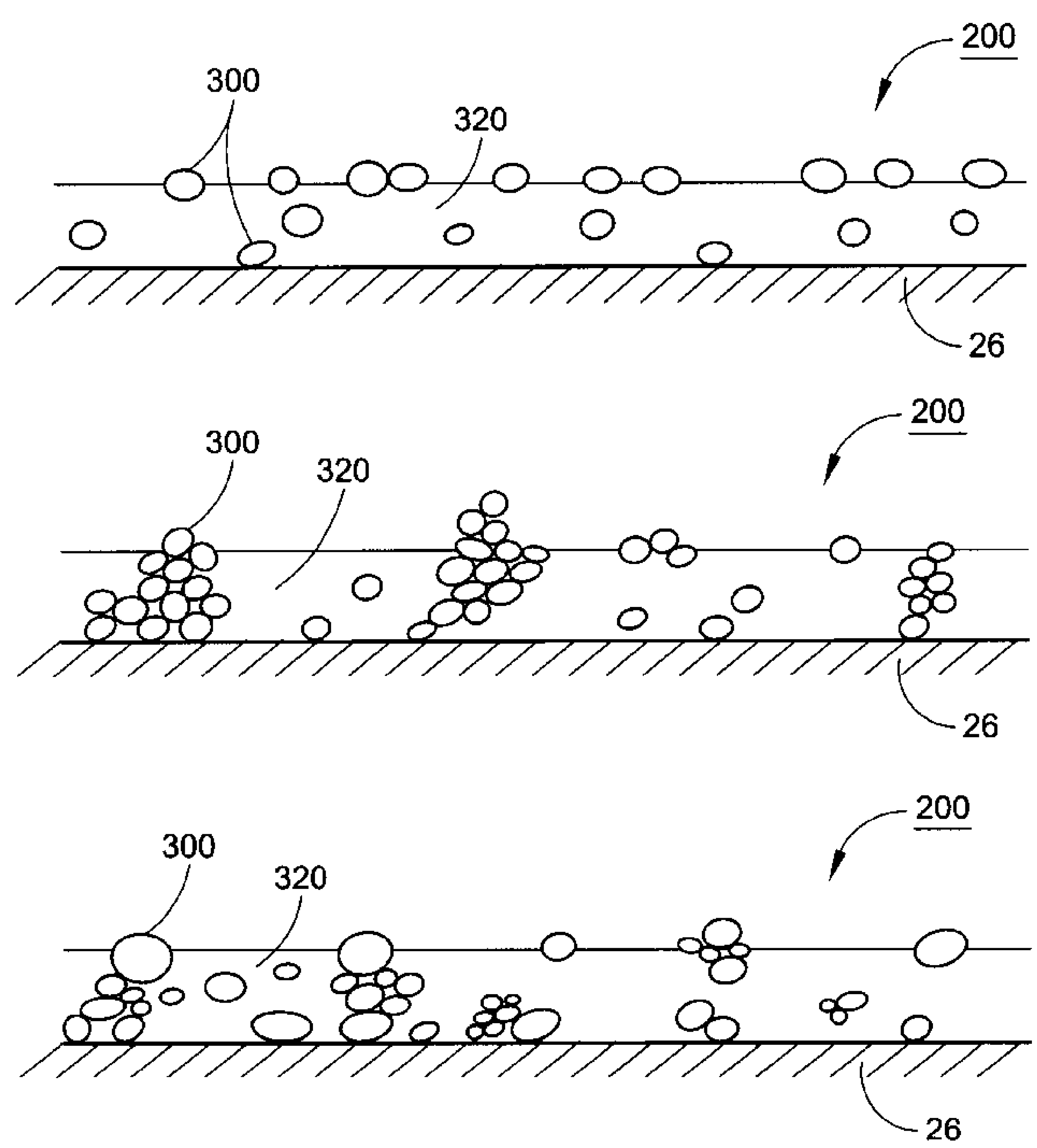
(74) *Attorney, Agent, or Firm*—Michael A. Catania

(57) **ABSTRACT**

A golf club having a club head composed of a composite material and having an enhanced sound during impact with a golf ball. The golf club head also has a coefficient of restitution greater than 0.8 under test conditions such as the USGA test conditions specified pursuant to Rule 4—1e, Appendix II, of the Rules of Golf for 1998–1999. The golf club head body has a weight strip placed within a ribbon of the body. The sound of the composite golf club head during impact with a golf ball is approximately equivalent to that of a metal wood during impact with a golf ball. The composite golf club head of the present invention has a combined sound level greater than one hundred seventeen decibels during impact with a golf ball.

2 Claims, 9 Drawing Sheets



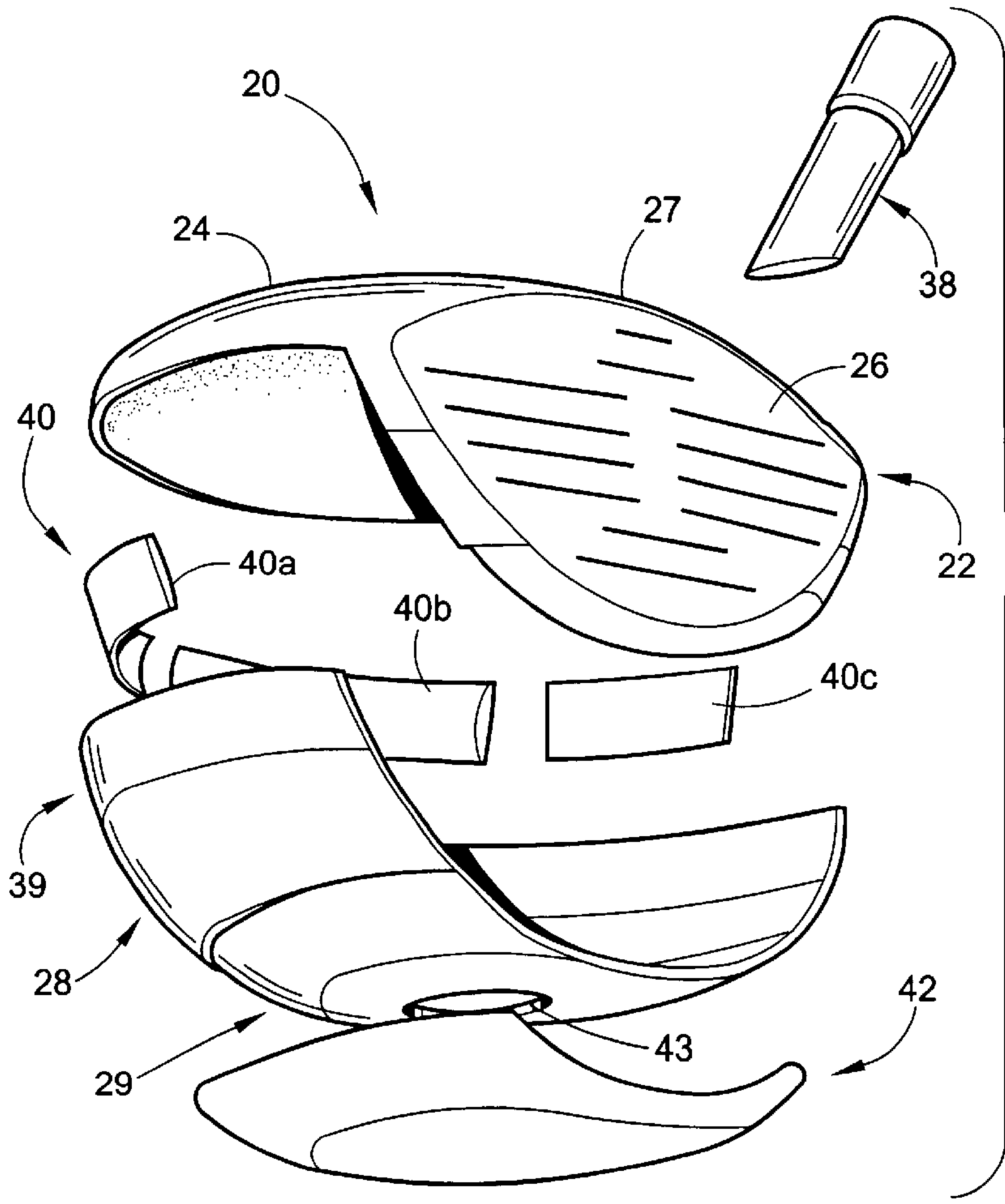


FIG. 1

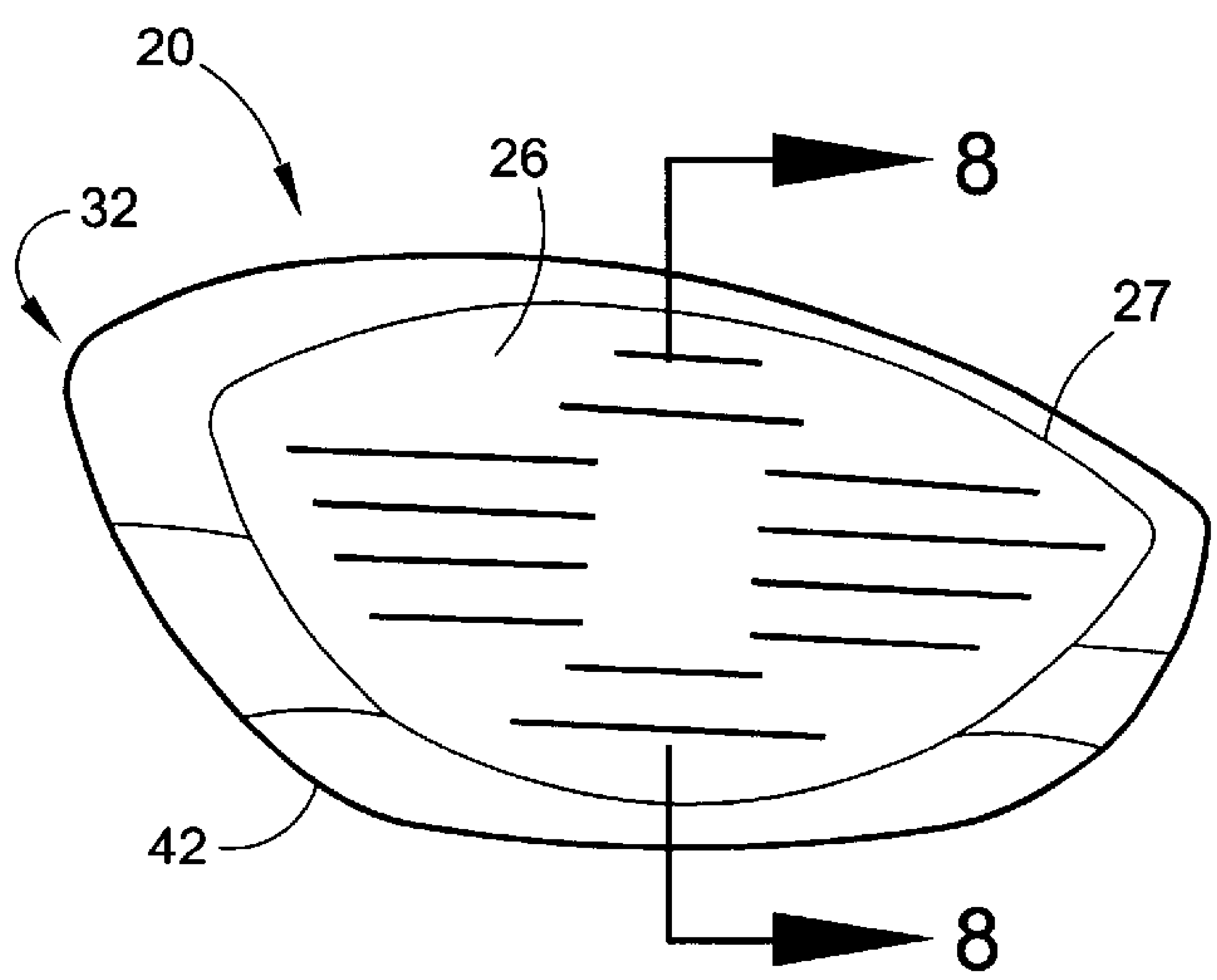


FIG. 2

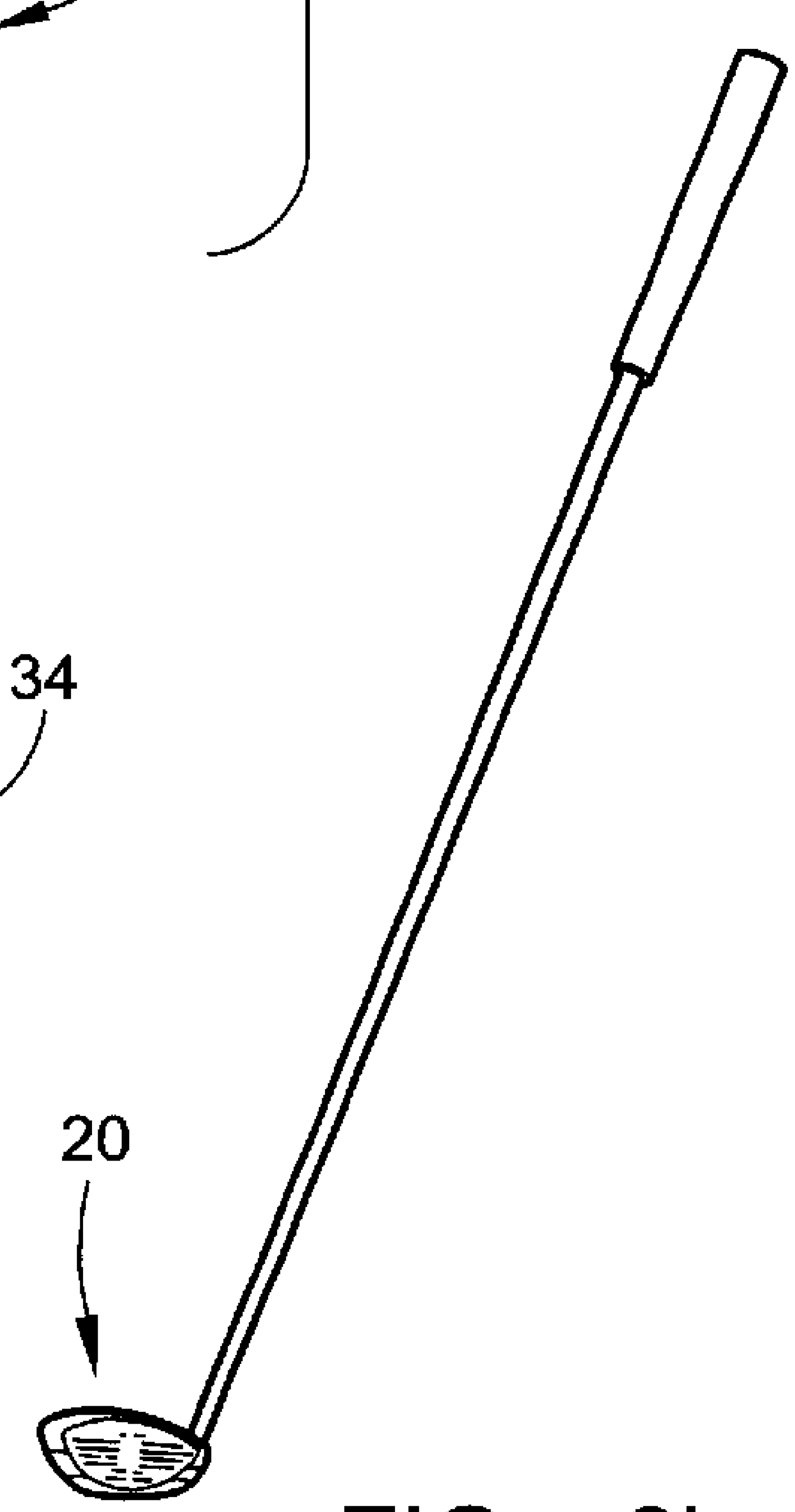


FIG. 2b

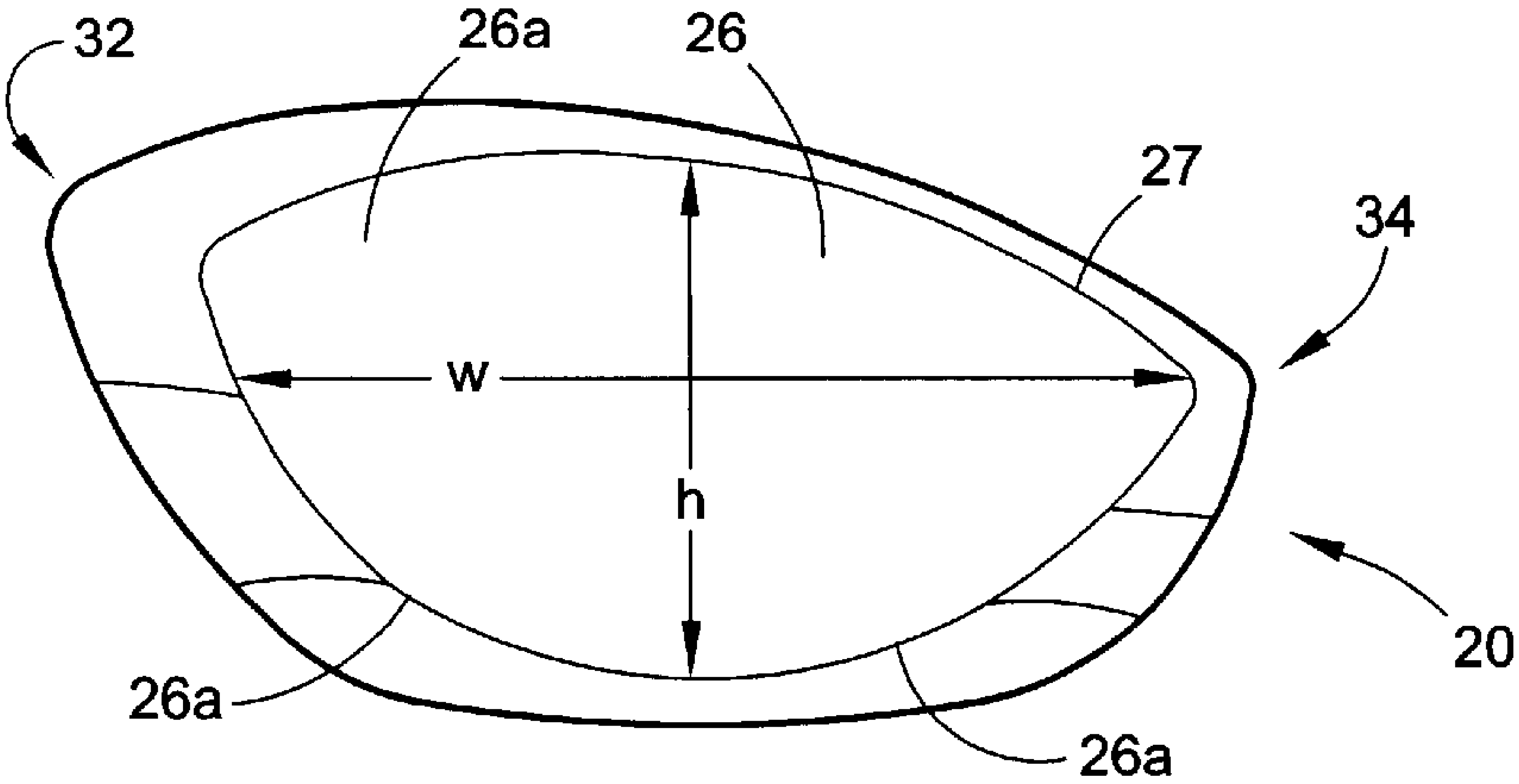


FIG. 2a

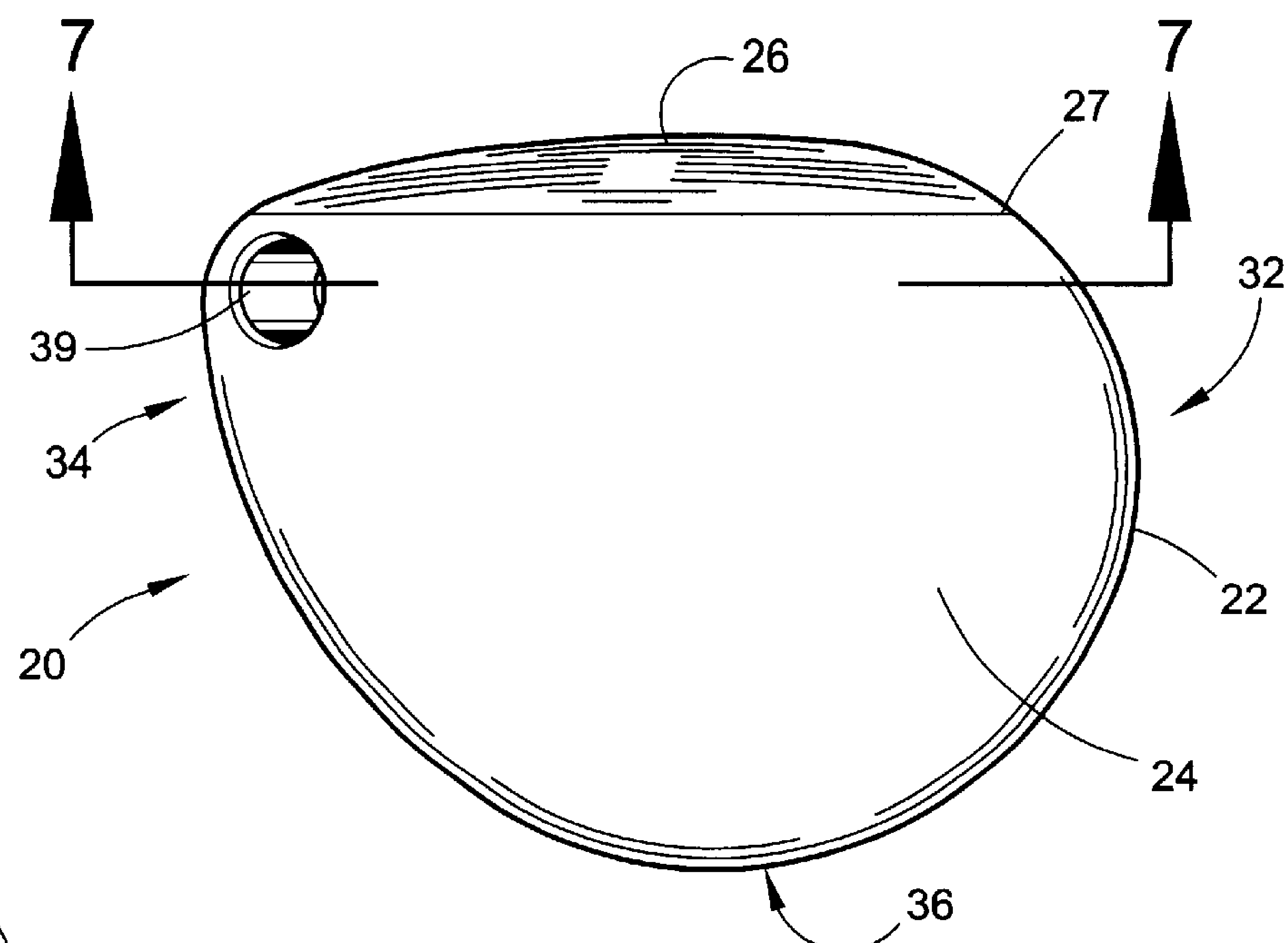


FIG. 3

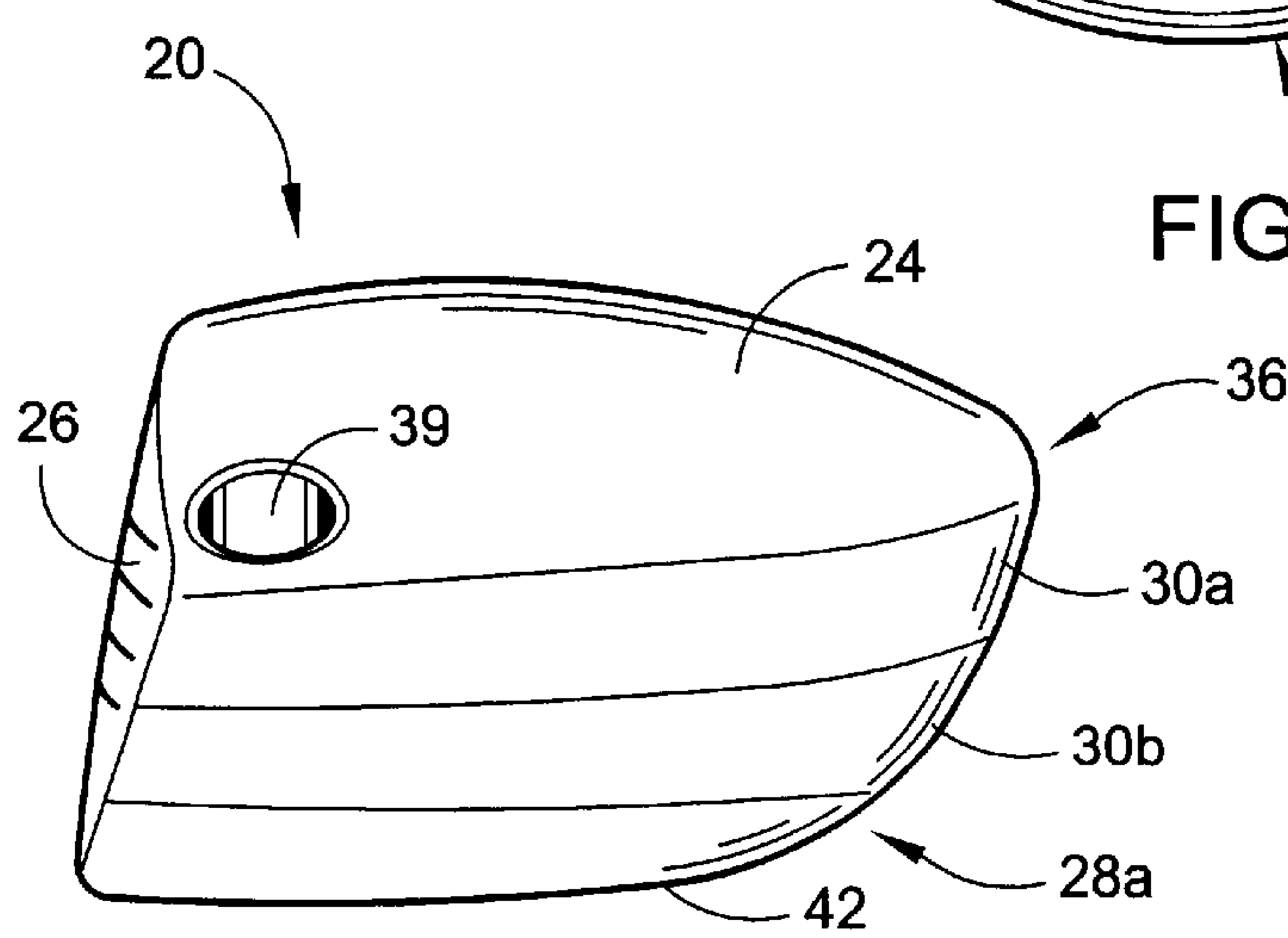


FIG. 4

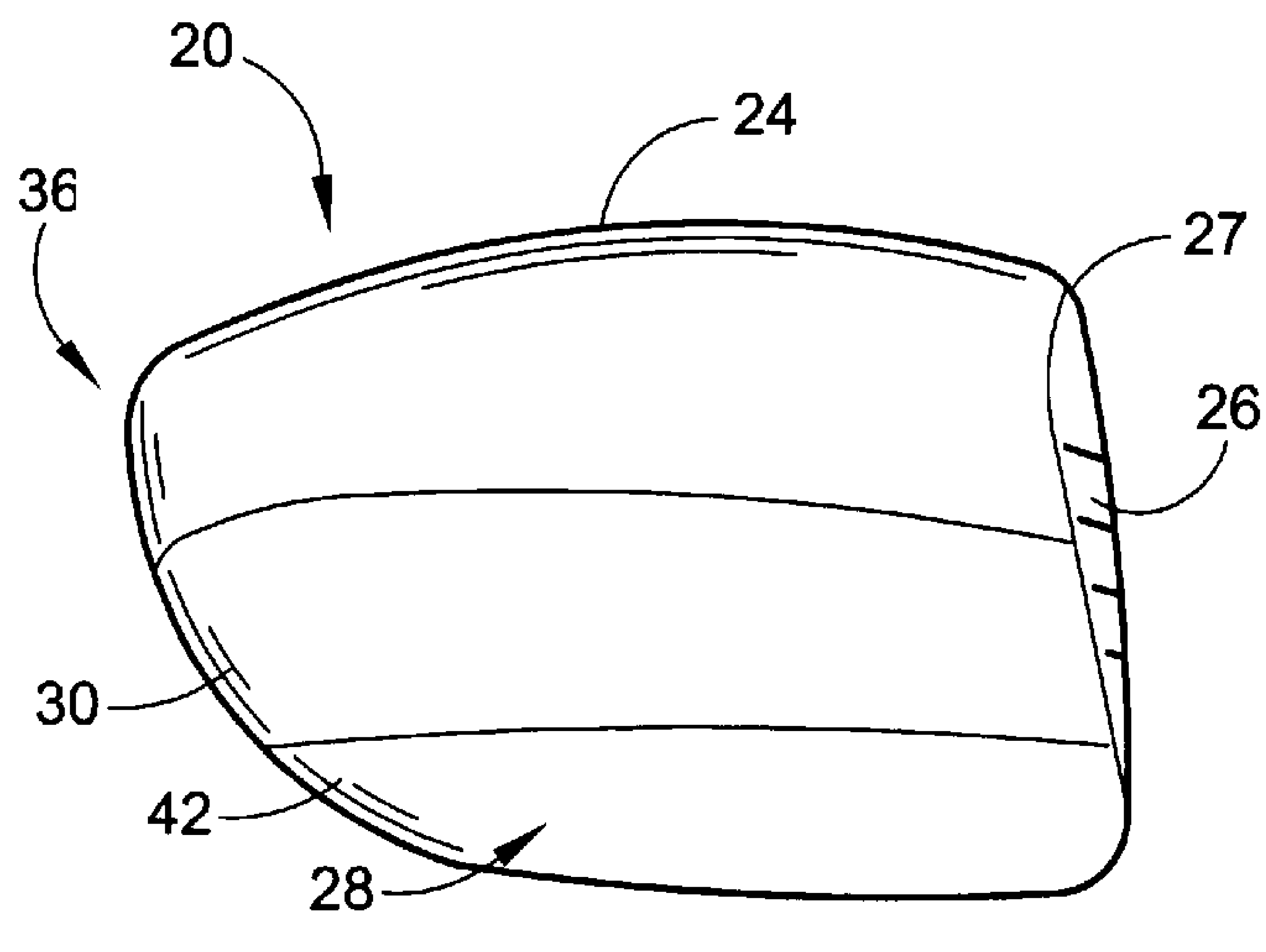


FIG. 5

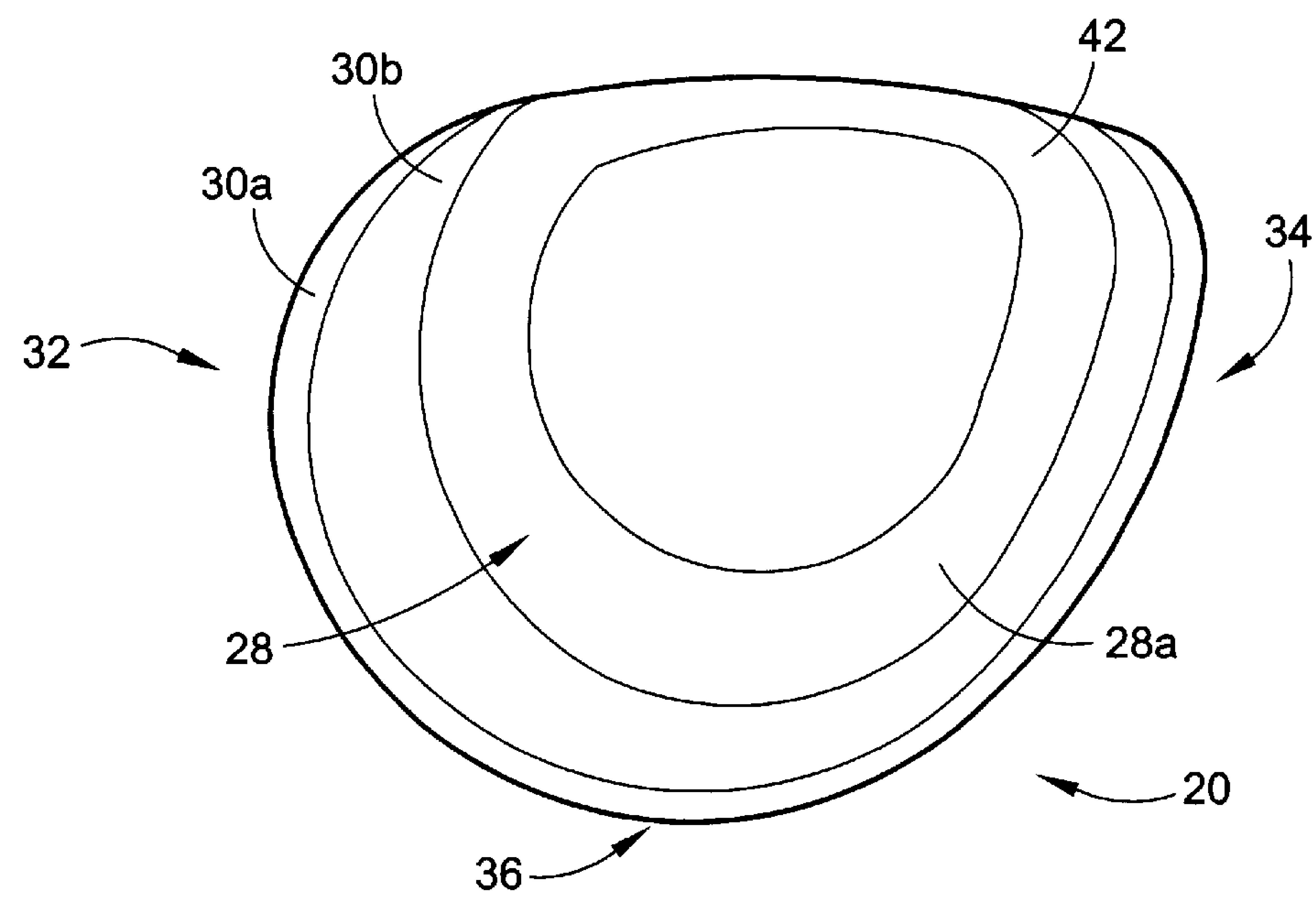


FIG. 6

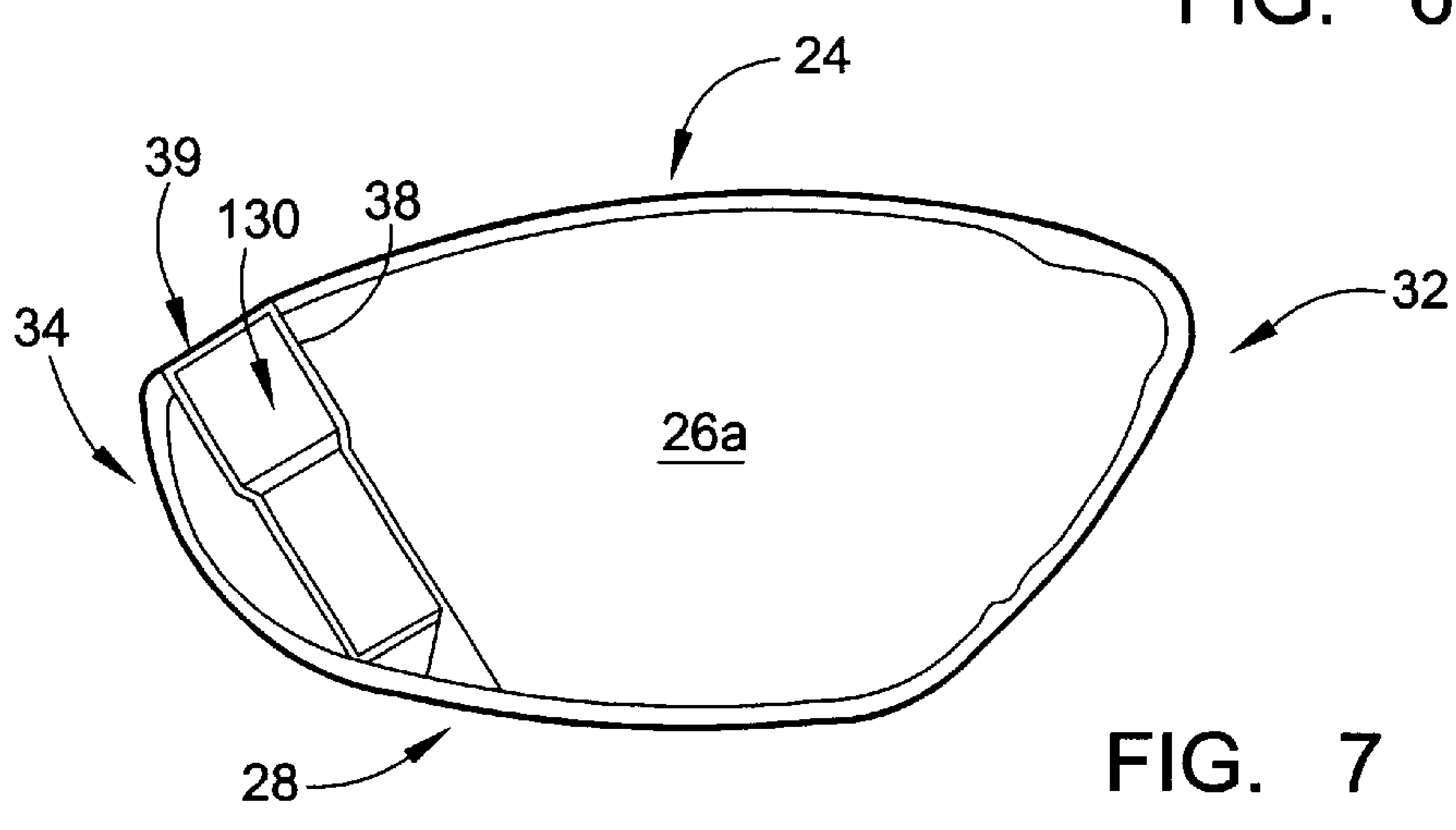


FIG. 7

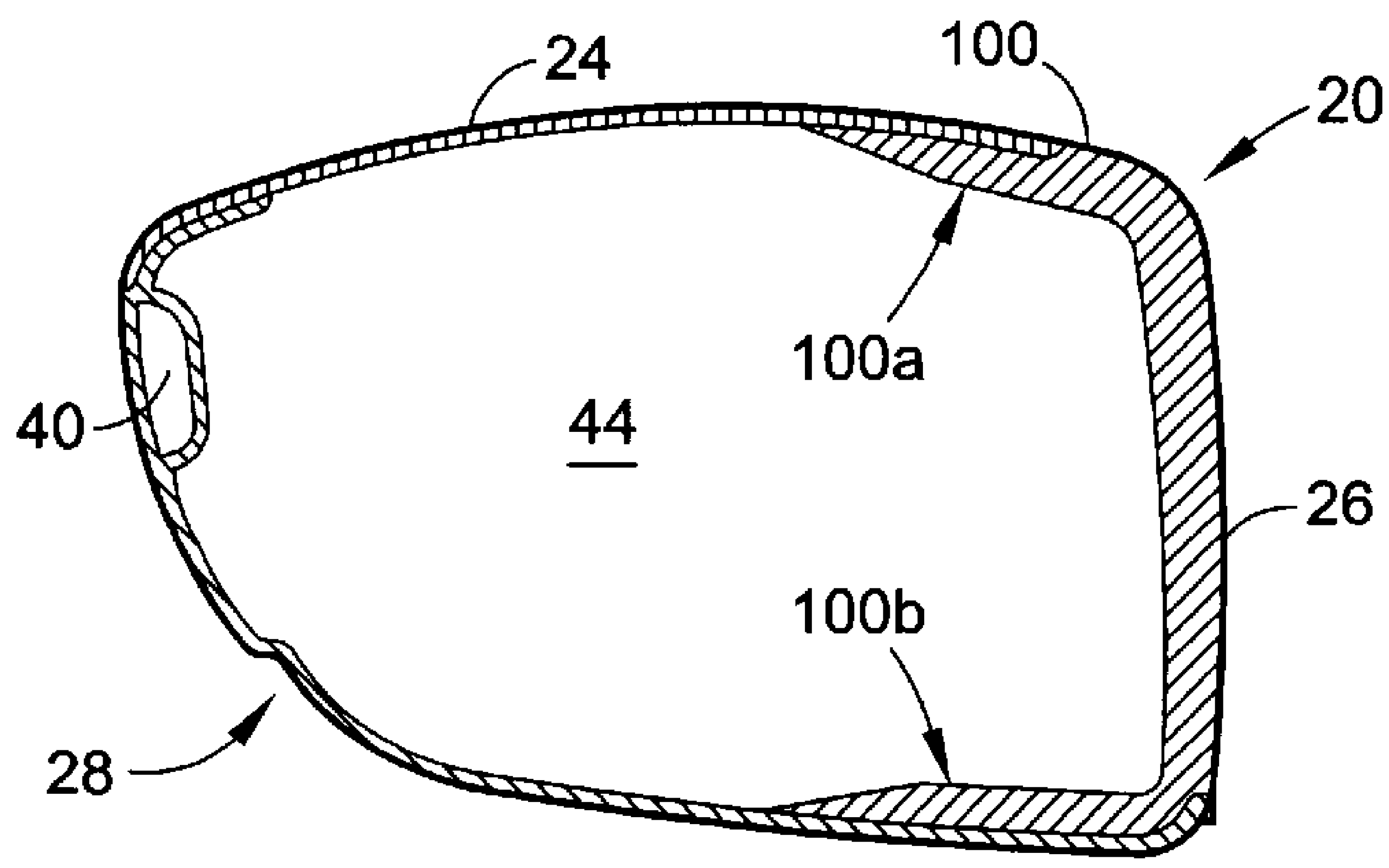


FIG. 8

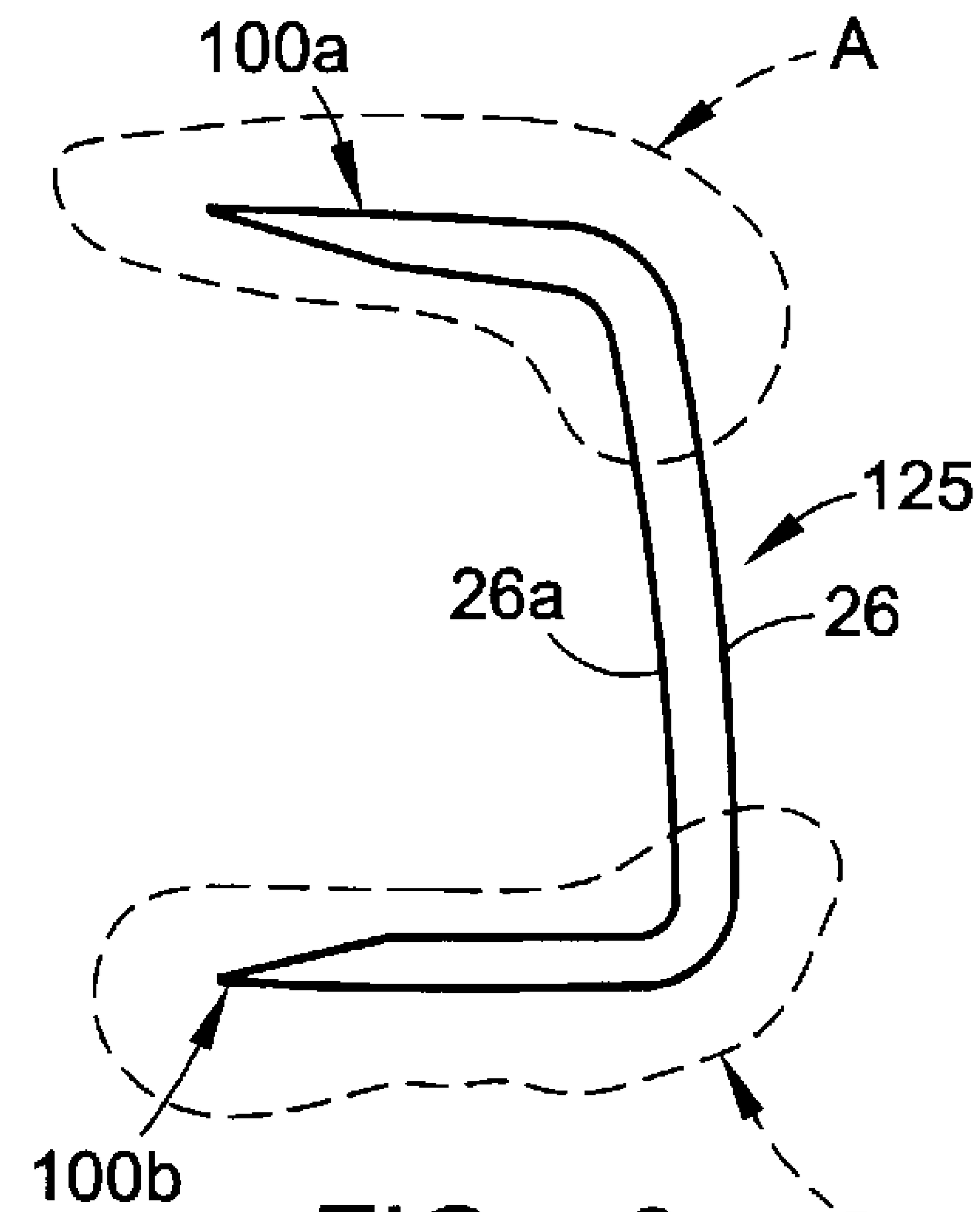


FIG. 9

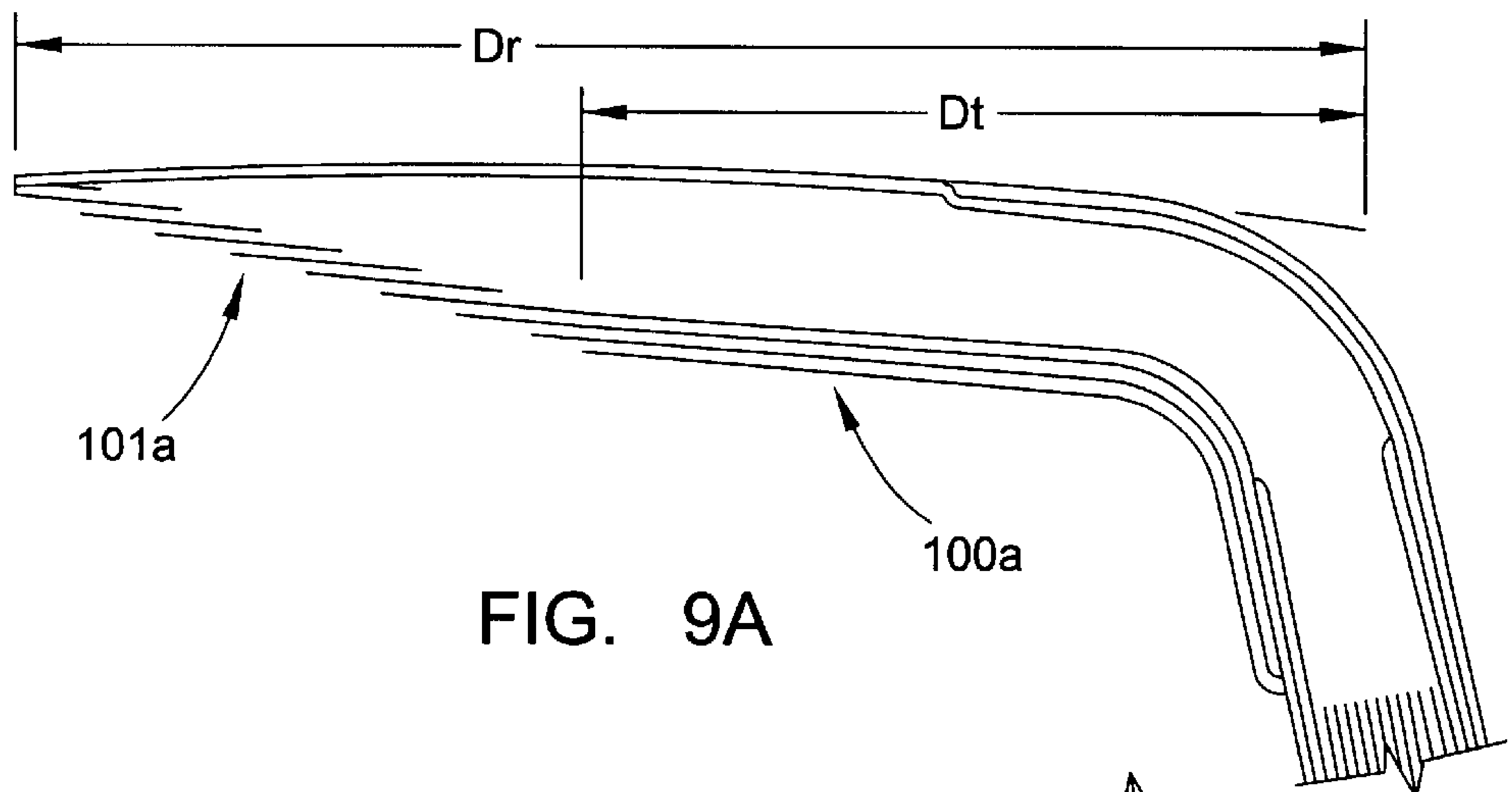


FIG. 9A

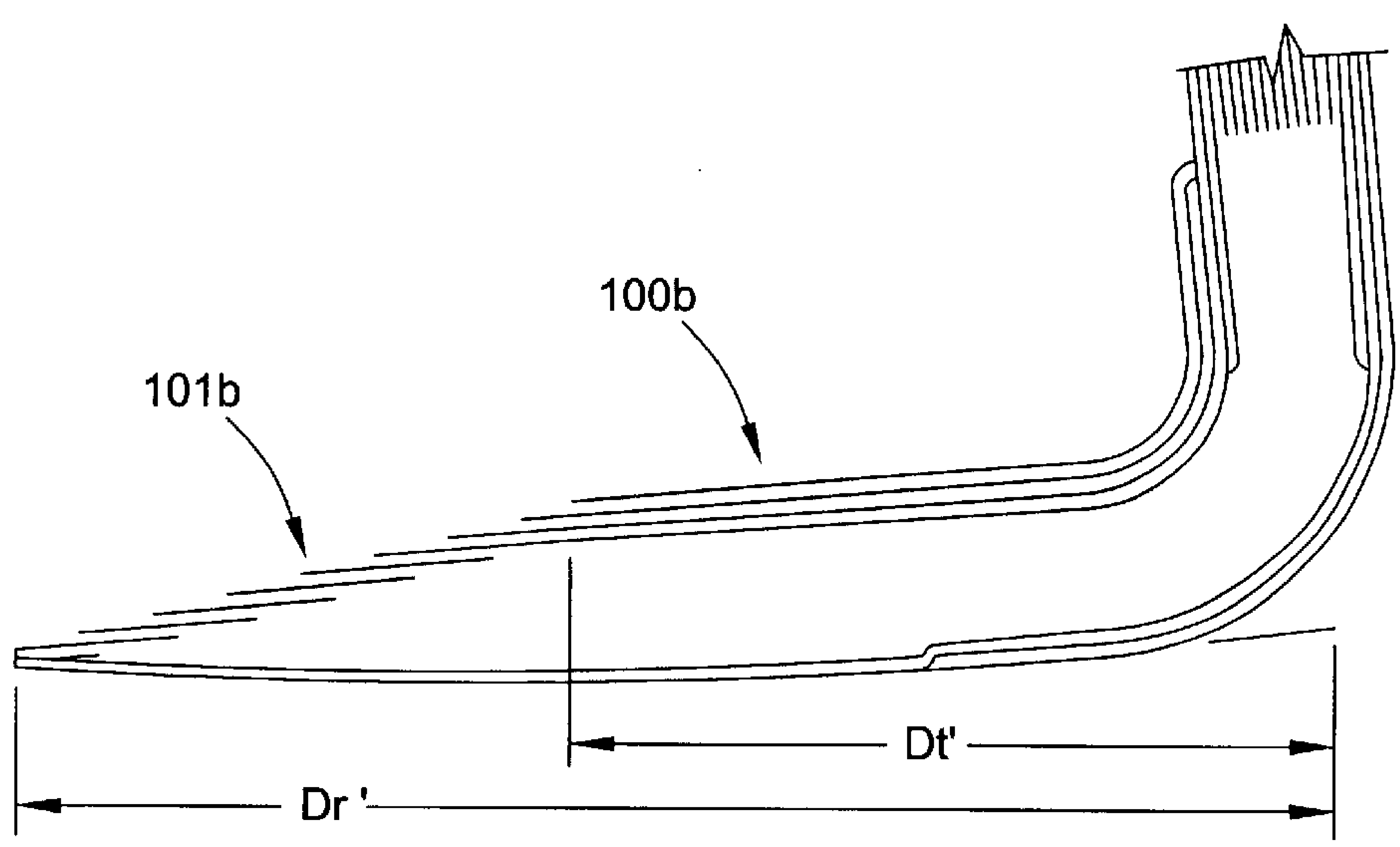


FIG. 9B

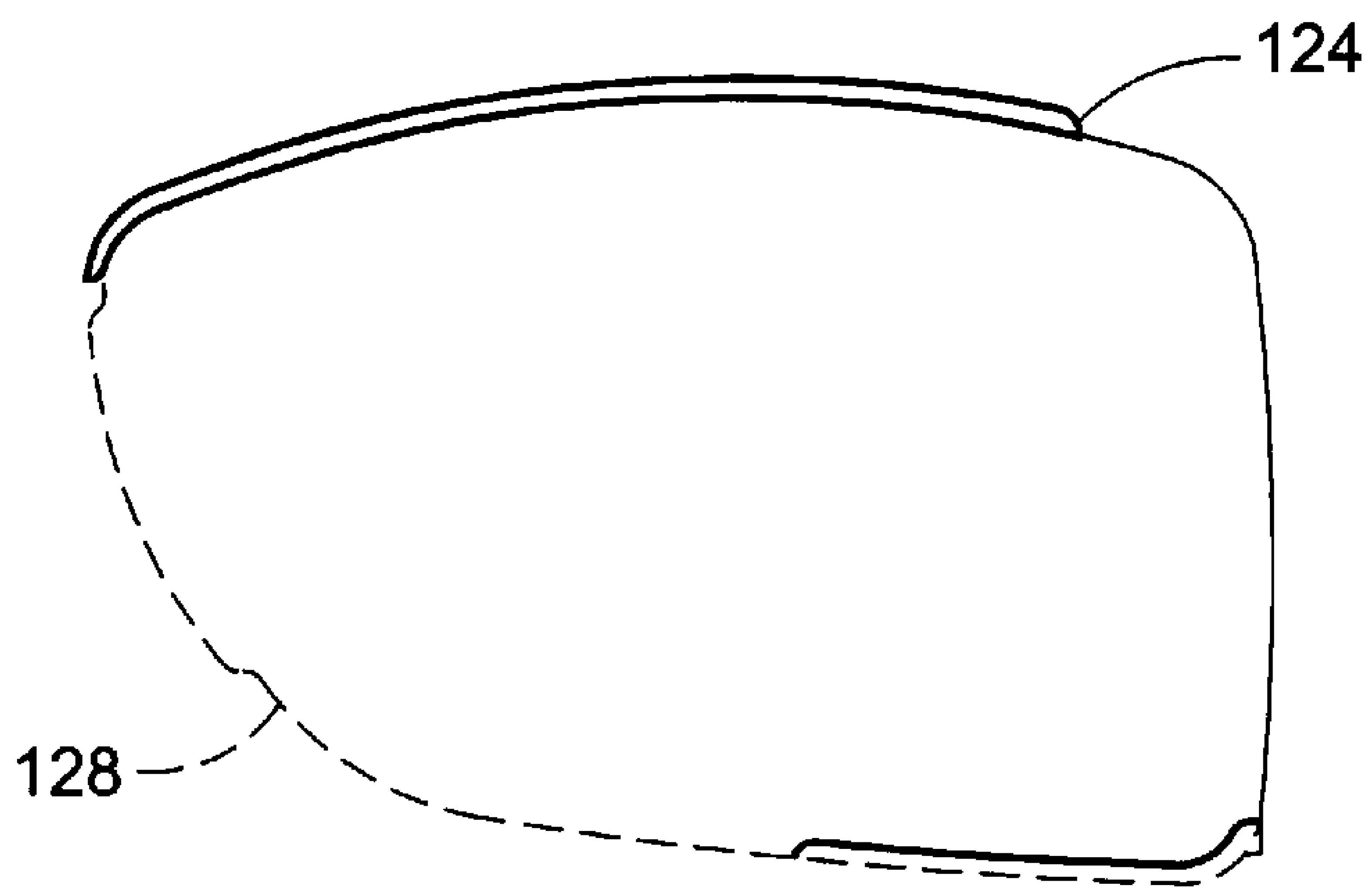


FIG. 10

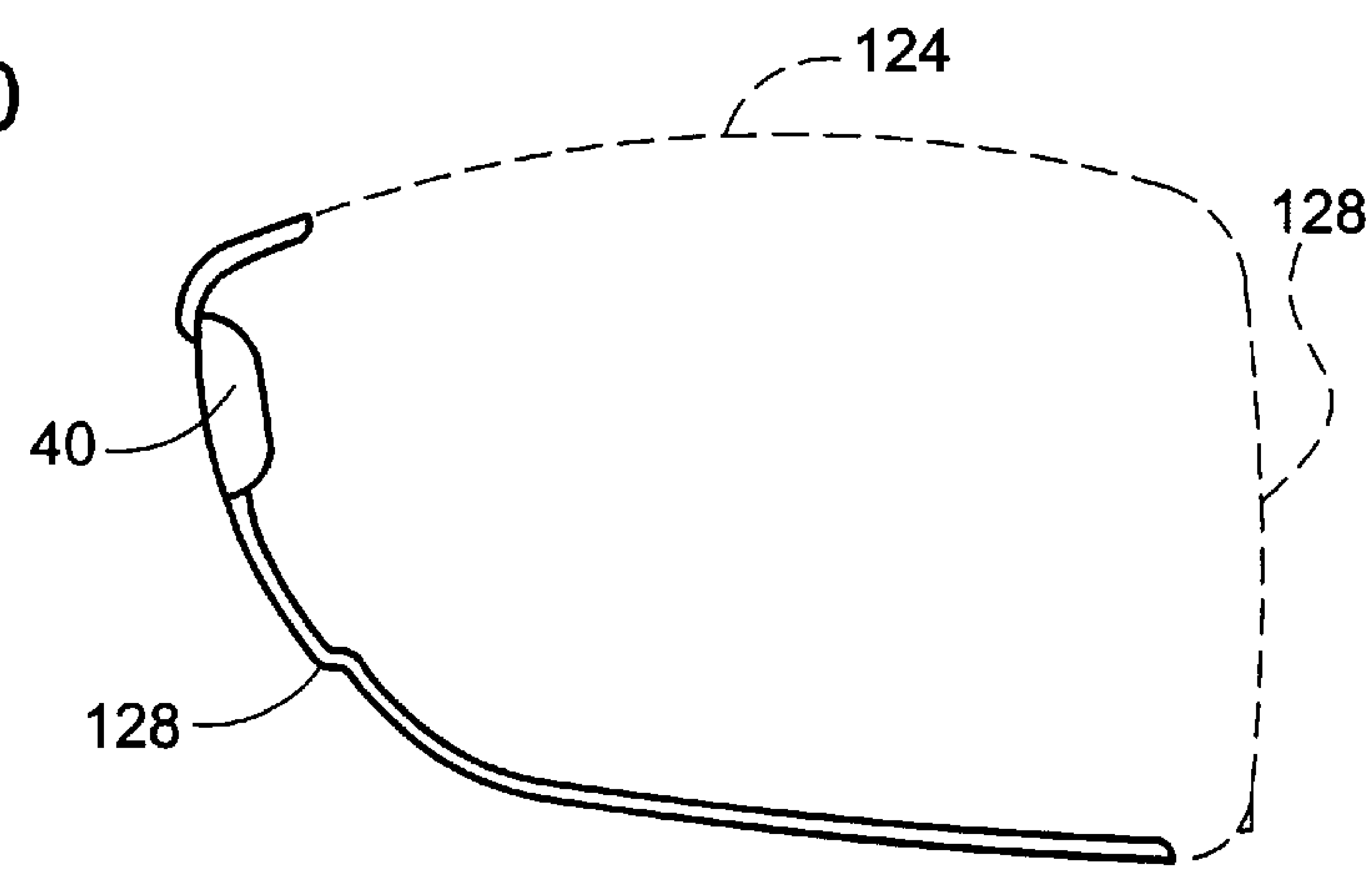


FIG. 11

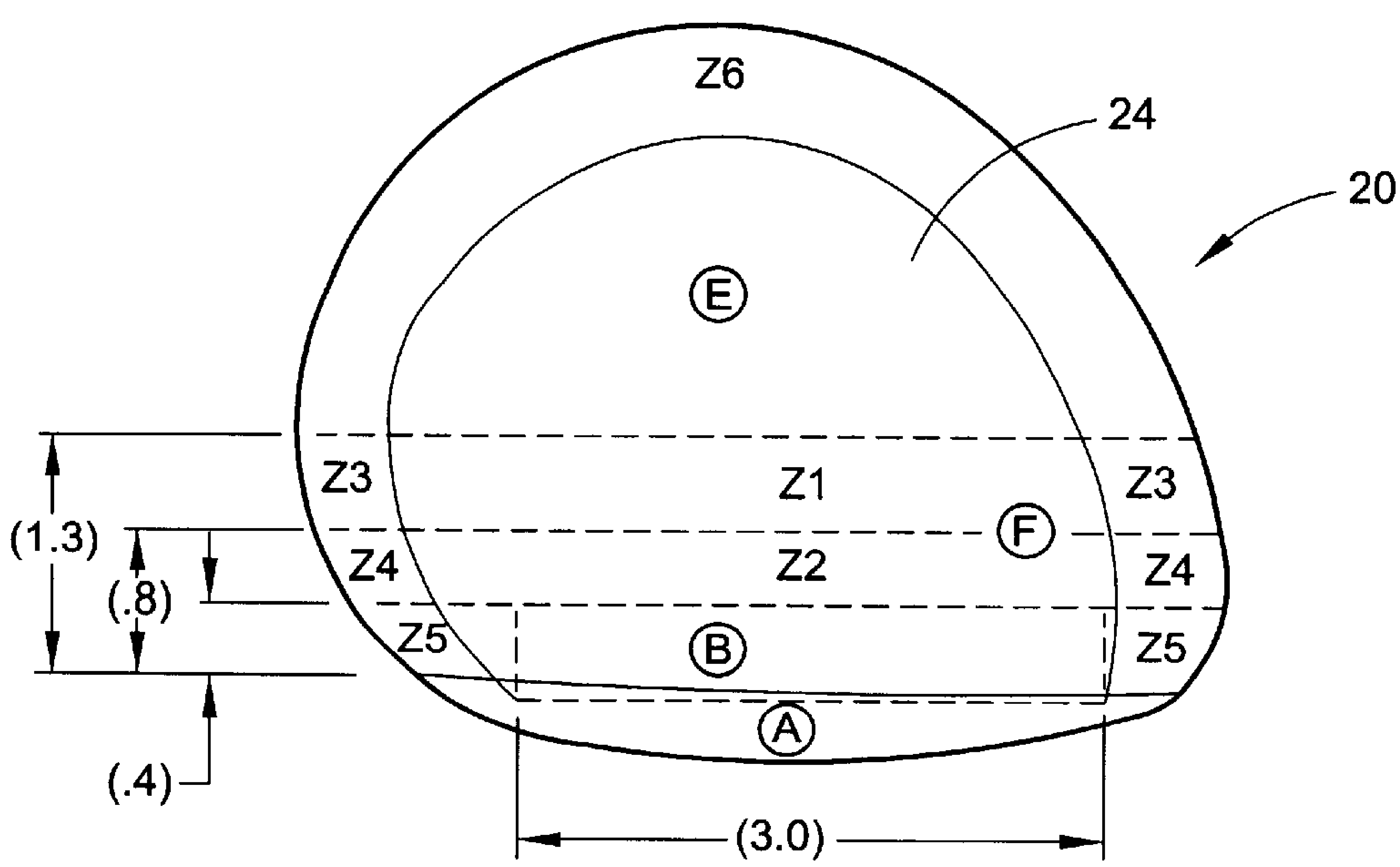


FIG. 12

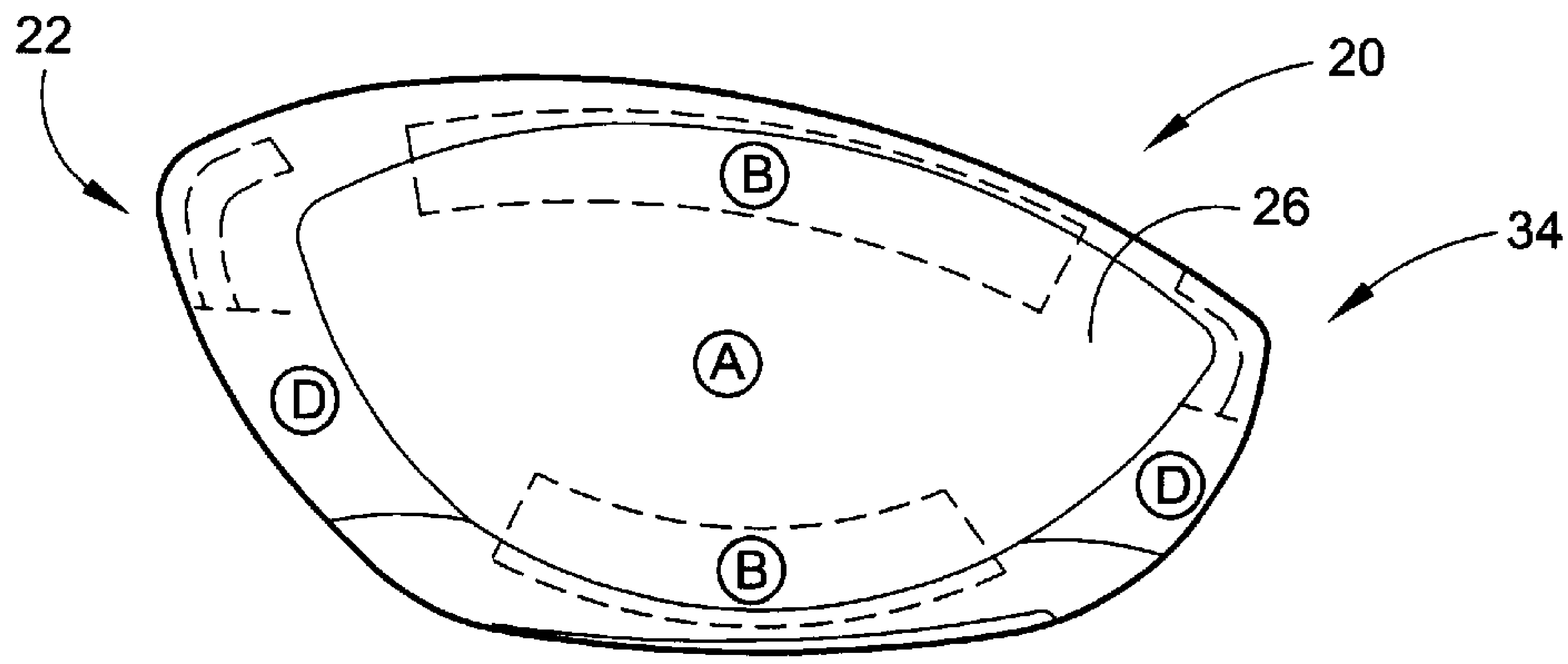


FIG. 13

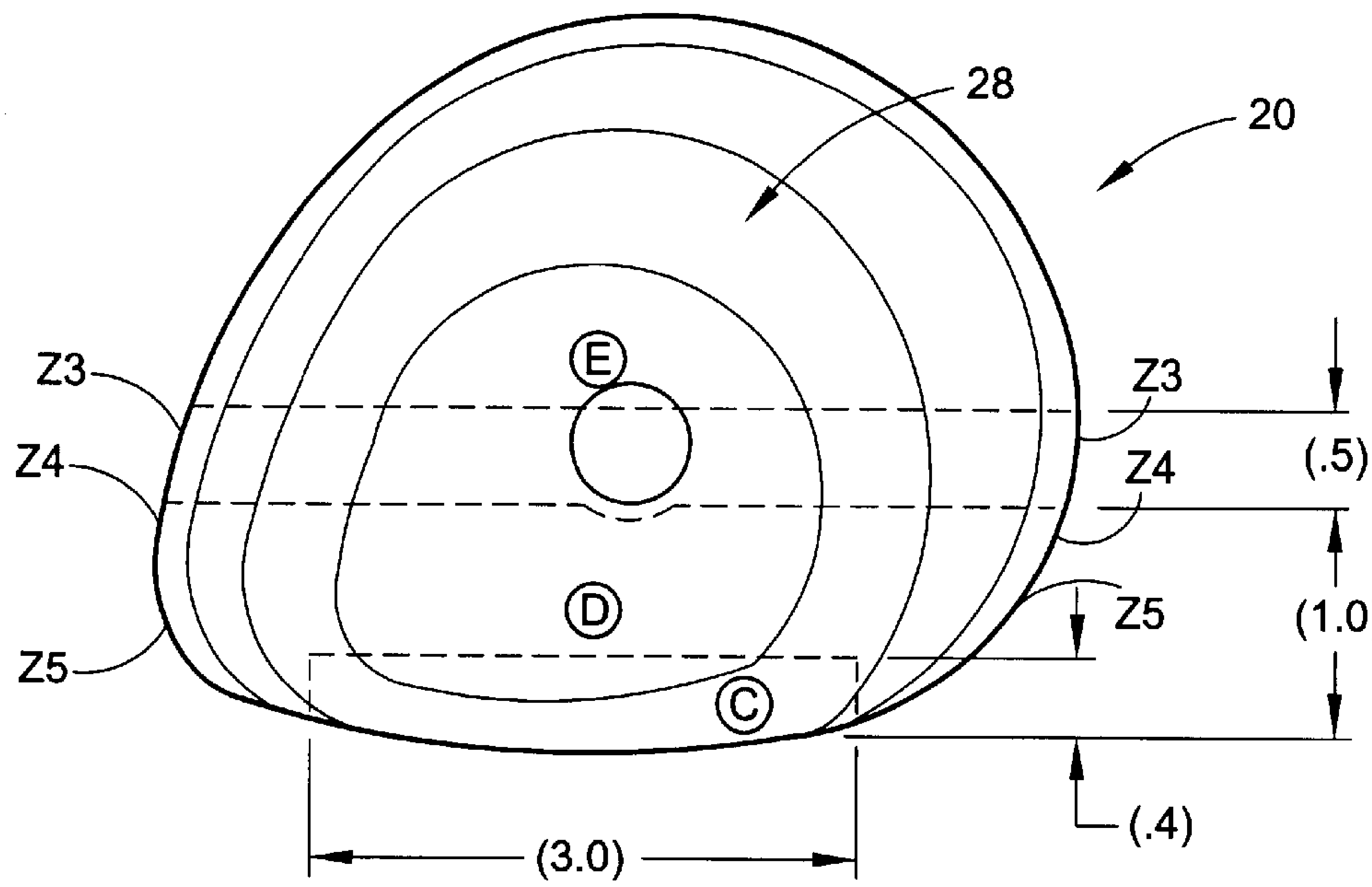


FIG. 14

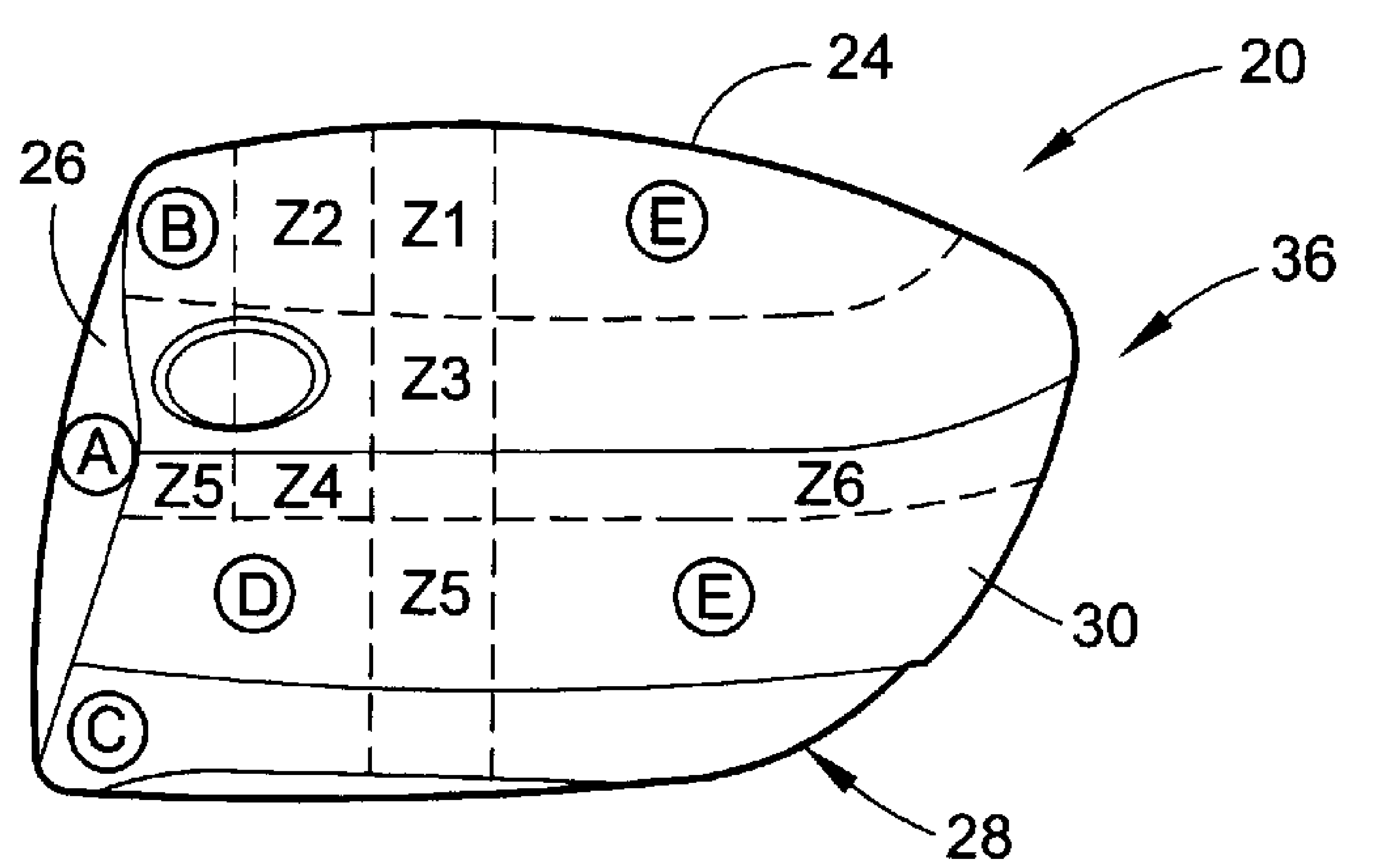


FIG. 15

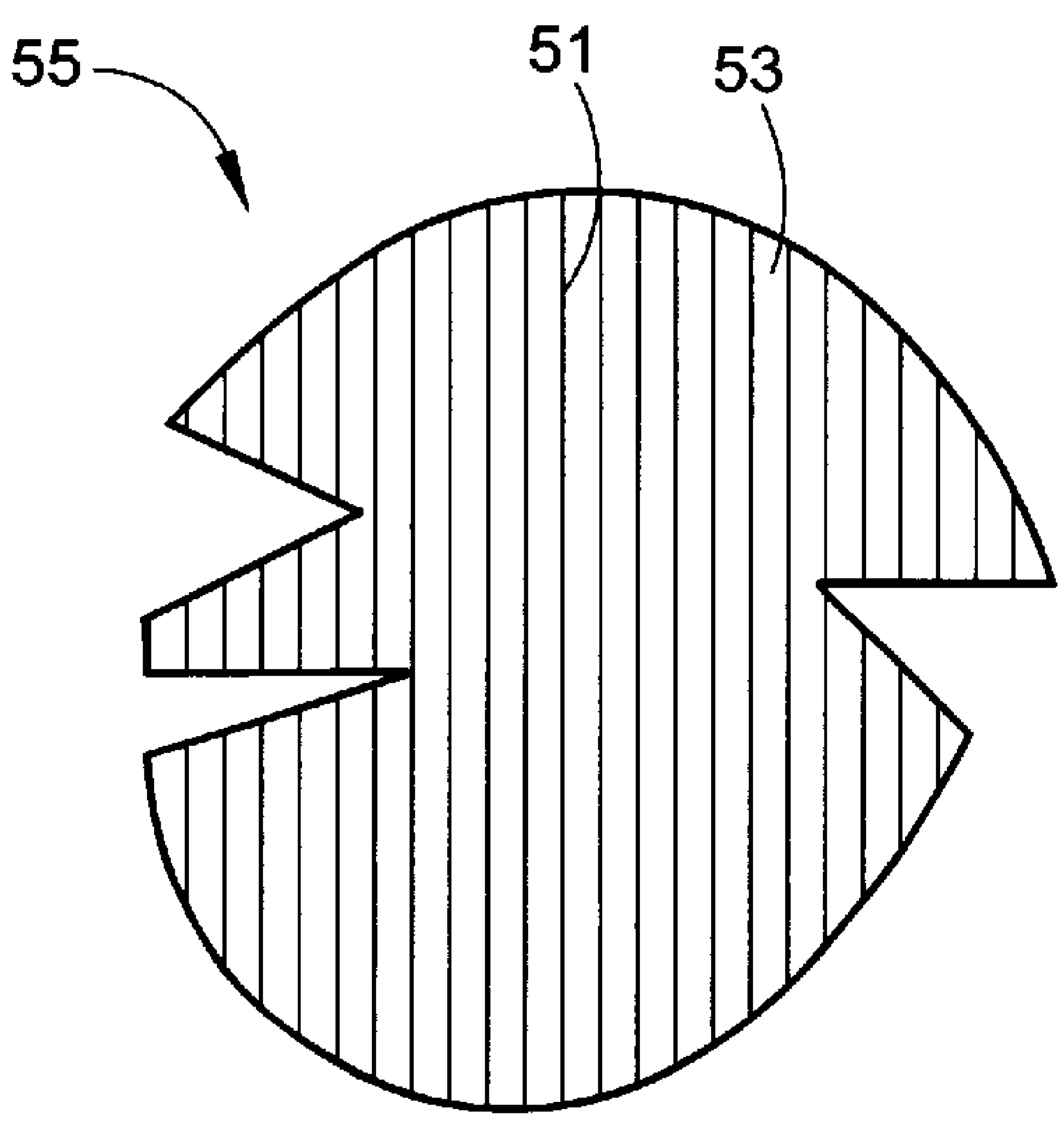


FIG. 16

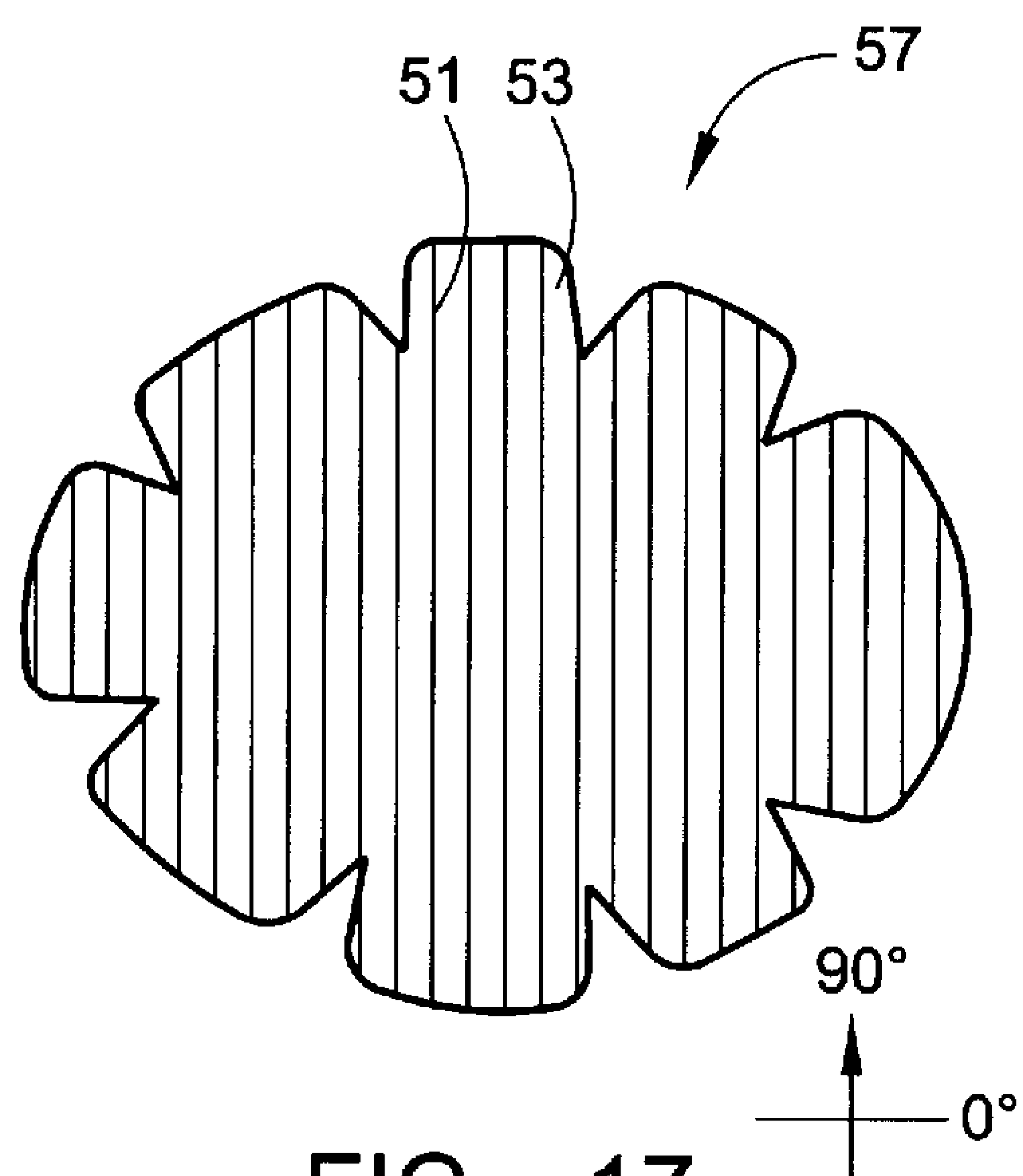


FIG. 17

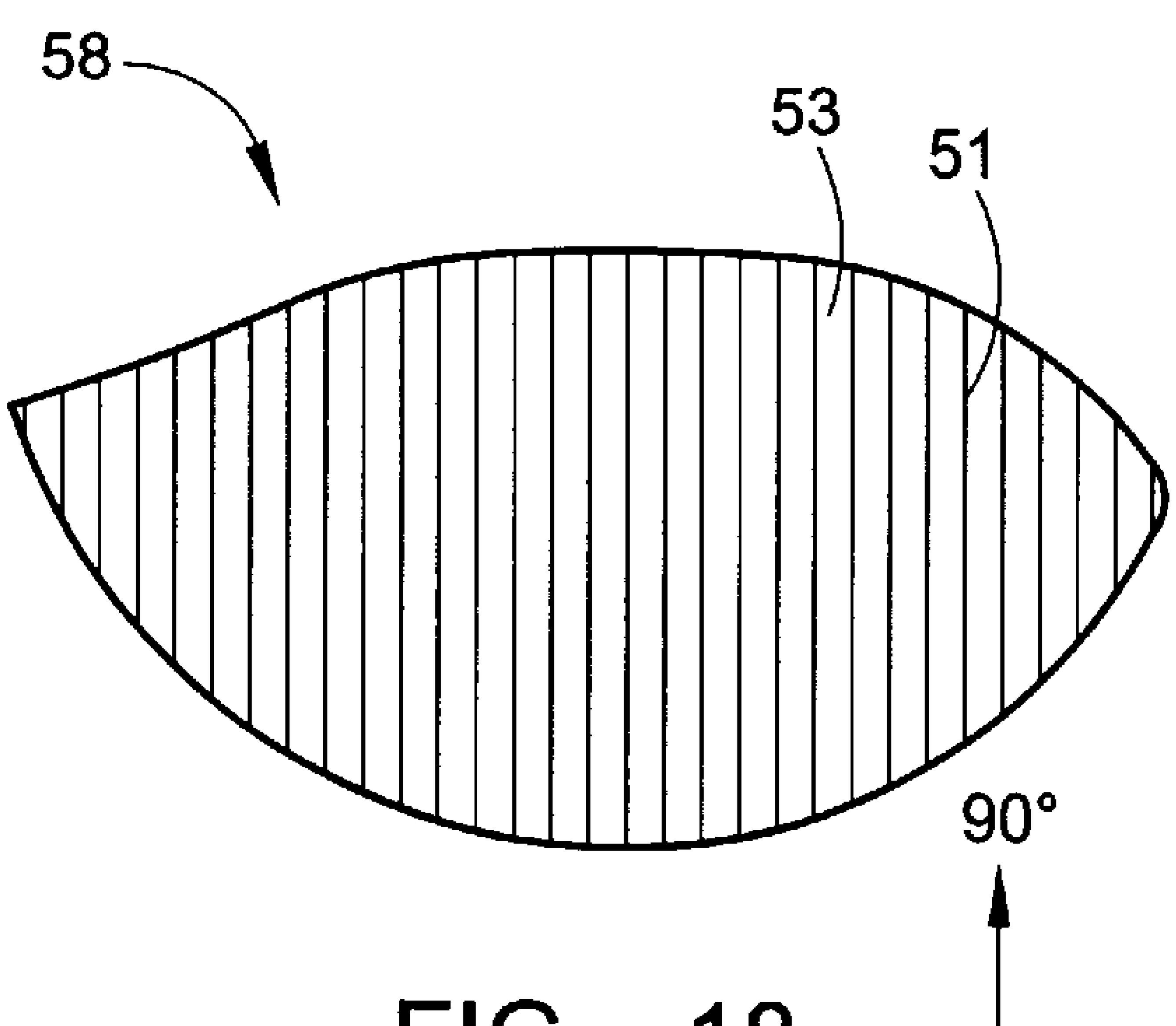


FIG. 18

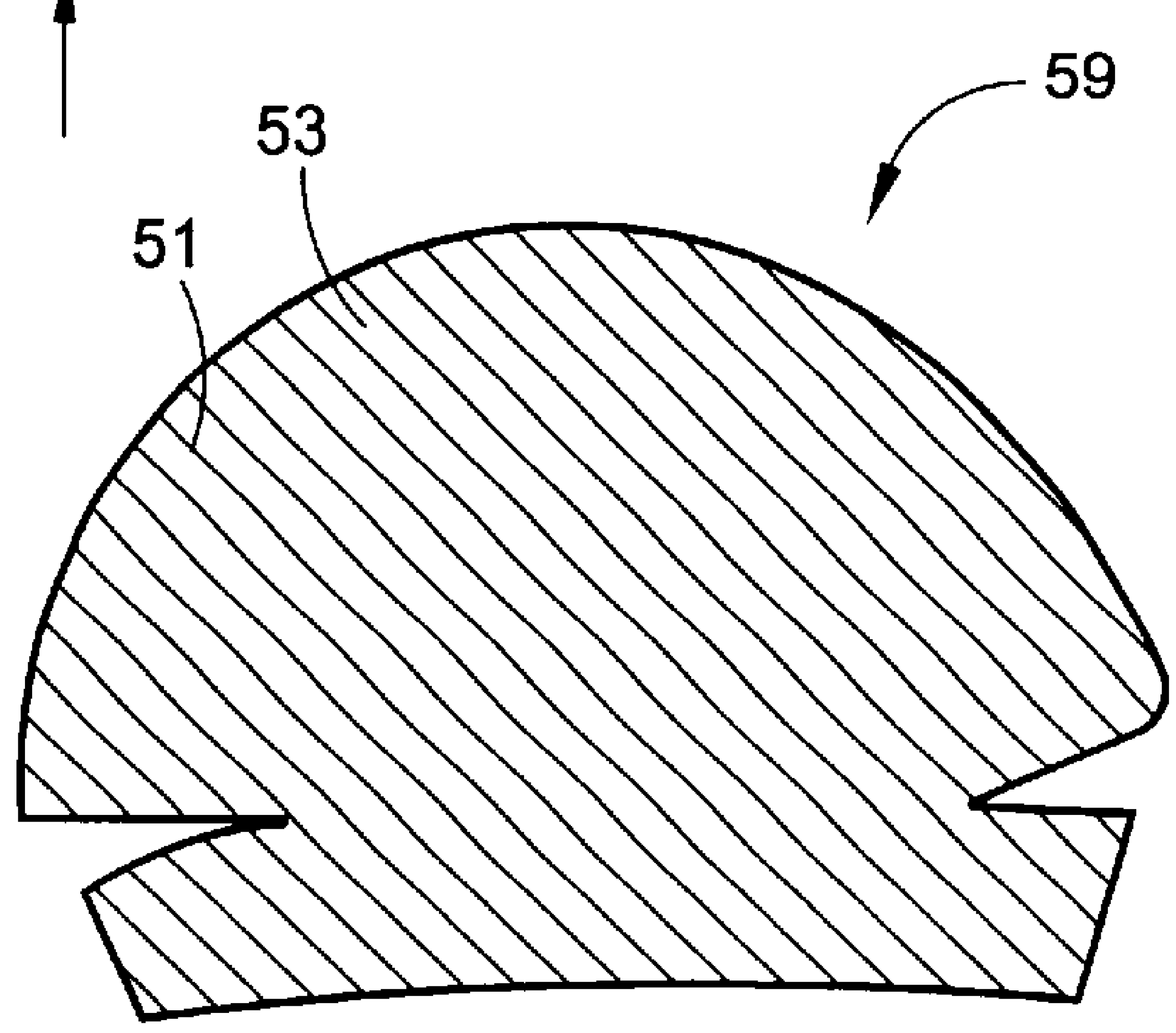


FIG. 19

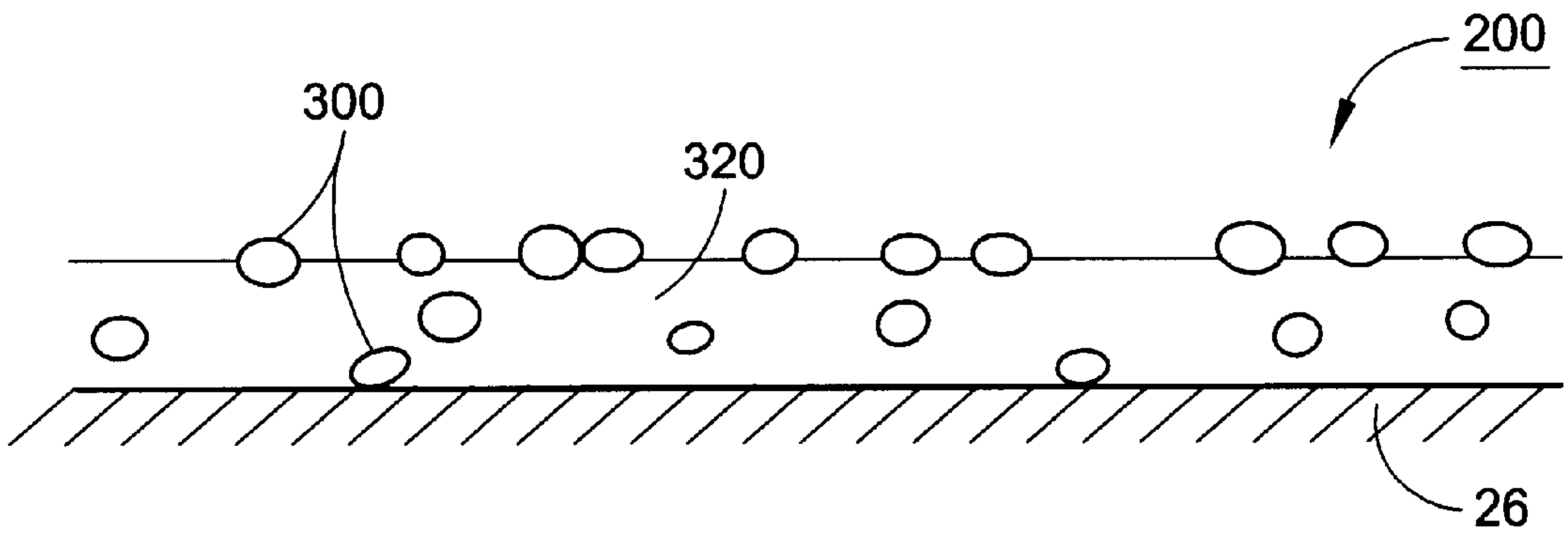


FIG. 20A

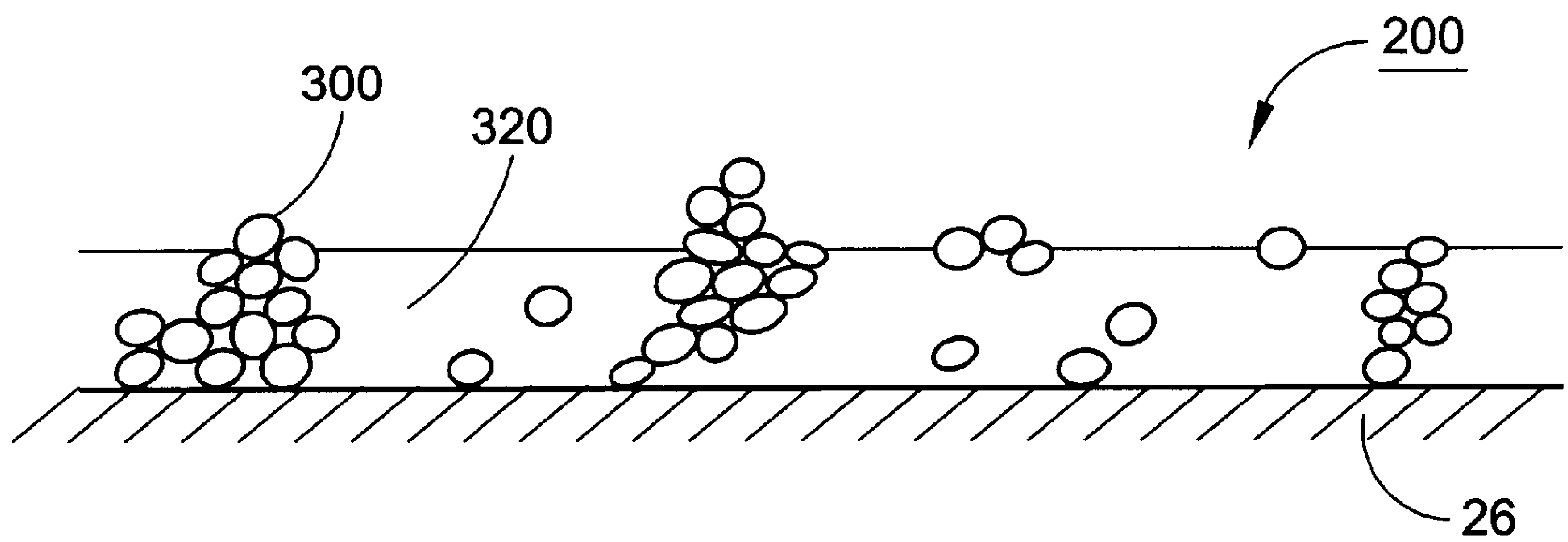


FIG. 20B

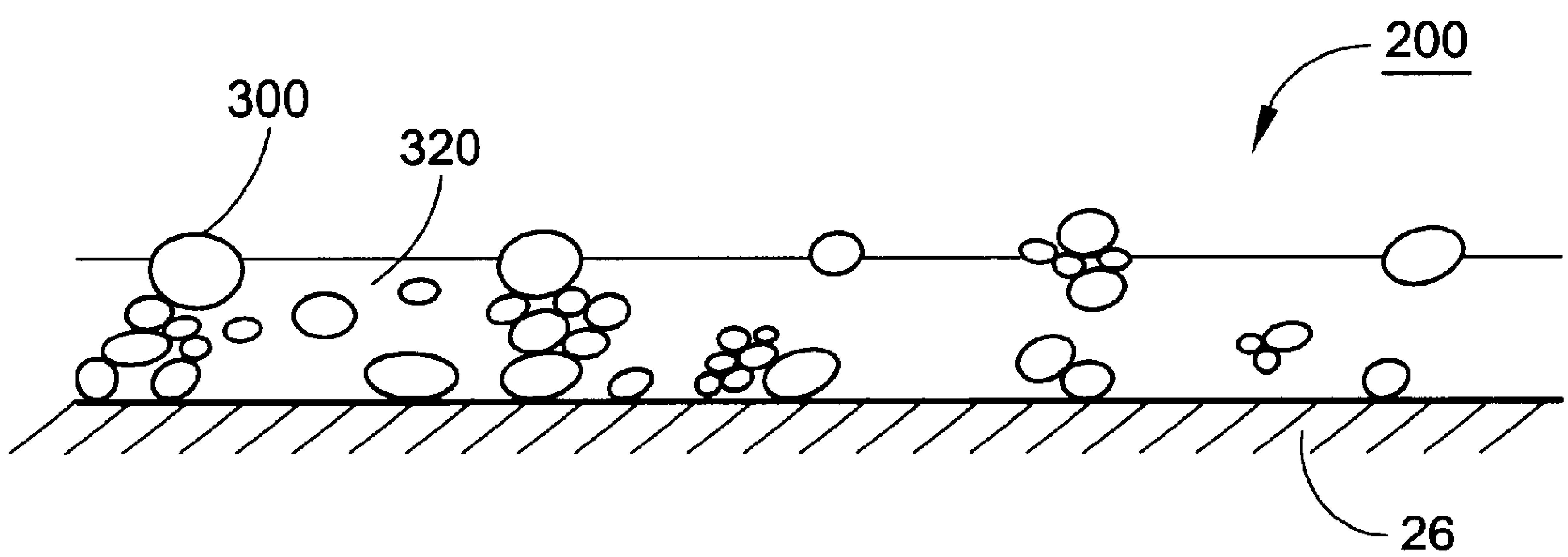


FIG. 20C

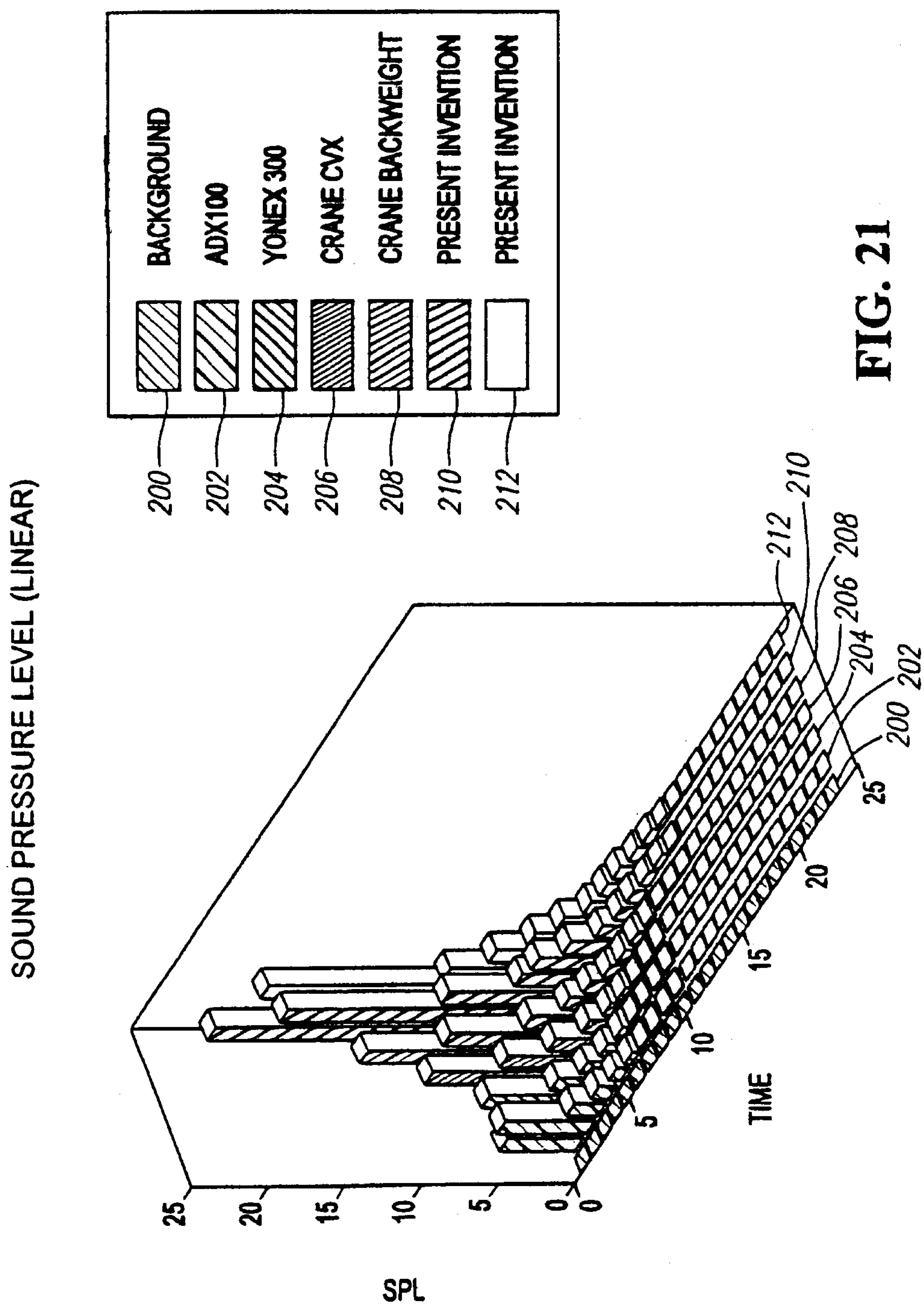

SOUND PRESSURE LEVEL (LINEAR)
SPL
TIME
200 BACKGROUND
202 ADX100
204 YONEX 300
206 CRANE CVX
208 CRANE BACKWEIGHT
210 PRESENT INVENTION
212 PRESENT INVENTION
0
5
10
15
20
25

FIG. 21

SOUND ENHANCE COMPOSITE GOLF CLUB HEAD

CROSS REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part application of U.S. patent application Ser. No. 09/474,697, filed on Dec. 29, 1999, now U.S. Pat. No. 6,406,378 which is a continuation-in-part of U.S. patent application Ser. No. 08/958,723, filed on Oct. 23, 1997, now U.S. Pat. No. 6,010,411.

FEDERAL RESEARCH STATEMENT

[Not Applicable]

BACKGROUND OF INVENTION

1. Field of the Invention

The present invention relates to a golf club head composed of a composite material. More specifically, the present invention relates to a golf club head composed of composite material and designed to have an enhanced sound when impacting a golf ball.

2. Description of the Related Art

When a golf club head strikes a golf ball, large impacts are produced that load the club head face and the golf ball. Most of the energy is transferred from the head to the golf ball, however, some energy is lost as a result of the collision. The golf ball is typically composed of polymer cover materials (such as ionomers) surrounding a rubber-like core. These softer polymer materials having damping (loss) properties that are strain and strain rate dependent which are on the order of 10–100 times larger than the damping properties of a club striking plate.

Golfers have become accustomed to hearing a particular sound when the club face impacts the golf ball, especially when a driver or fairway wood is used by the golfer. This sound expectation has grown tremendously since the introduction of hollow metal woods. This particular sound imparts a sensation to the golfer of a good shot, a quality club or both.

The sound expectation from a metal wood has become so entrenched that woods lacking this particular sound are believed to be inferior or are undesired by golfers. This sound expectation has greatly effected composite golf clubs since current composite golf clubs have an undesirable "thud" sound, reminiscent of persimmon woods.

Further, the current manufacturers of composite golf clubs have had no desire to improve the sound since improving the performance and lowering the costs of the composite golf clubs have been the major design concerns of such manufacturers. Thus, although the performance and price of composite golf clubs have improved, the sound has remained unchanged and is an obstacle to increased acceptance of composite golf clubs.

SUMMARY OF INVENTION

The present invention provides a composite golf club head that has a predetermined sound during impact with a golf ball. The present invention is able to accomplish this by designing the composite golf club head in a particular shape and orienting the plies of pre-preg composite sheets to enhance the sound during impact with a golf ball.

Having briefly described the present invention, the above and further objects, features and advantages thereof will be recognized by those skilled in the pertinent art from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is an exploded view of a golf club head of the present invention.

FIG. **2** is a front view of a golf club head of the present invention.

FIG. **2**A is a front view of a golf club head of the present invention.

FIG. **2**B is a front perspective view of a golf club utilizing a golf club head of the present invention.

FIG. **3** is a top plan view of a golf club head of the present invention.

FIG. **4** is a heel end view of a golf club head of the present invention.

FIG. **5** is a toe end view of a golf club head of the present invention.

FIG. **6** is a bottom plan view of a golf club head of the present invention.

FIG. **7** is a cross-sectional view of the golf club head of FIG. **3** along line **7**—**7**.

FIG. **8** is a cross-sectional view of the golf club head of FIG. **2** along line **8**—**8**.

FIG. **9** is an isolated cross-section view of a face preform of a golf club head of the present invention.

FIG. **9**A is an enlarged view of area A of FIG. **9**.

FIG. **9**B is an enlarged view of area B of FIG. **9**.

FIG. **10** is an isolated cross-section view of a crown/face preform of a golf club head of the present invention.

FIG. **11** is an isolated cross-section view of a sole preform of a golf club head of the present invention.

FIG. **12** is a top plan view of a golf club head of the present invention illustrating the variation in thickness of the walls of the golf club head.

FIG. **13** is a front plan view of a golf club head of the present invention illustrating the variation in thickness of the walls of the golf club head.

FIG. **14** is a bottom plan view of a golf club head of the present invention illustrating the variation in thickness of the walls of the golf club head.

FIG. **15** is a heel end view of a golf club head of the present invention illustrating the variation in thickness of the walls of the golf club head.

FIG. **16** is a plan view of a face/crown ply having a ninety degree orientation.

FIG. **17** is a plan view of a full face ply having a ninety degree orientation.

FIG. **18** is a plan view of a face doubler ply having a ninety degree orientation.

FIG. **19** is a plan view of a sole ply having a negative forty-five degree orientation.

FIG. **20** is a graph of time versus sound level for composite golf club heads.

FIG. **21** is a graph of time versus sound level for composite golf club heads with the sound level scaled to illustrate the differences between composite golf club heads.

DETAILED DESCRIPTION

The present invention is directed at a composite golf club head having an enhanced sound during impact with a golf ball while also having increased performance. More precisely, the composite golf club head of the present invention is louder over long periods of time relative to current composite golf club heads, and it has a high coefficient of restitution.

Sound, or specifically sound waves are longitudinal mechanical waves that compress a medium such as air to stimulate the human ear and brain for the sensation of hearing. The frequency range that can stimulate the human ear for hearing is designated the audible range and ranges from 20 Hertz (cycles) to 20,000 Hertz. The sound waves create a pressure that varies depending on the medium, the frequency and distance. The human ear can tolerate a sound pressure of 28 Pascals, and can detect a sound pressure as low as 2.0×10^{-5} Pascals. Sound, or the sound level, is measured in decibels (named after Alexander Graham Bell), and is a parameter related to the intensity of a sound wave according to the following equation:

$\beta=10\ \log_{10}(I/I_o)$ wherein I is the intensity and I_o is a standard reference intensity ($I_o=10^{-12}$ W/m^2). The intensity may be found from the pressure amplitude wherein the average intensity $I=(½)\ P_m^{\ 2}/v\rho_o$ wherein P_m=the pressure amplitude of the sound in air, v=the velocity of sound in air, and ρ_o=the density of air. When $I=I_o$, the sound level is zero decibels which is the threshold of hearing. For reference, a whisper is twenty decibels, normal conversation is sixty decibels, a pneumatic drill at a distance of three meters has a sound level of ninety decibels, and a jet engine at fifty meters has a sound level of one hundred thirty decibels. A golf club striking a golf ball will emit certain sound levels according to the material and construction of the golf club.

As shown in FIGS. **1–6**, a golf club head of the present invention is generally designated **20**. The club head **20** is either a fairway wood or a driver. The drivers range in loft angle of from six degrees to fifteen degrees. The club head **20** has a body **22** that is generally composed of a composite material such as plies of carbon pre-preg sheets. The body **22** has a crown **24**, a striking plate **26**, a sole **28** with a bottom portion **28***a* and a ribbon **30**. The ribbon preferably has an upper ribbon wall **30***a* and a lower ribbon wall **30***b*. The ribbon **30** generally extends from a toe end **32** to a heel end **34**. The ribbon **30** generally begins at one end of the striking plate **26** and ends at an opposite end of the striking plate **26**. A rear **36** of the body **22** is opposite the striking plate **26** and is defined by portions of the ribbon **30**, the crown **24** and the sole **28**. Also, at the heel end **34** of the club head **20** is an internal tube **38** with an opening **39** for placement of a shaft therein. The internal tube **38** is placed within the hollow interior **44** of the body **22**. Within the ribbon is a weight member **40**.

A sole plate **42** is disposed within a recess **29** of the bottom portion **28***a* of the sole **28**. The sole plate **42** is preferably composed of a metal material such as aluminum or titanium, and preferably has a mass of 5 grams to 20 grams. A preferred mass for an aluminum sole plate **42** is approximately 11 grams, and a preferred mass for a titanium sole plate **42** is approximately 18 grams. The sole plate **42** is preferably bonded within the recess **29** through use of adhesives. The sole plate **42** preferably has embossed graphics thereon. The sole plate **42** increases the durability of the club head **20** since the sole **28** often impacts the ground during the striking of a golf ball.

The club head **20** of the present invention also has a greater volume than a composite club head of the prior art while maintaining a weight that is substantially lower or equivalent to that of the prior art. The volume of the club head **20** of the present invention ranges from 175 cubic centimeters to 450 cubic centimeters, more preferably ranges from 300 cubic centimeters to 400 cubic centimeters, and is most preferably 360 cubic centimeters for a driver. The mass of the club head **20** of the present invention ranges from 165 grams to 300 grams, preferably ranges from 175 grams to 225 grams, and most preferably from 188 grams to 195 grams. The body **22** of plies of pre-preg material has a mass ranging from 80 grams to 120 grams, and most preferably 98 grams.

The volume of the present invention is increased by increasing the vertical distance of the club head **20** from the sole **28** to the crown **24**, as opposed to the horizontal distance of the heel end **34** to the toe end **32**. This increase in volume is brought about by the dual wall structure of the ribbon **30**. The upper ribbon wall **30***a* is approximately perpendicular relative to the crown **24**, while the lower ribbon wall **30***b* preferably has angle between 25 degrees to 75 degrees relative to the crown **24**.

The greater volume of the club head **20** allows the club head **20** to be more forgiving than prior art golf club heads while providing better performance. The mass of club head **20** is much lower than metal club heads of similar volumes, and thus the large volume does not deter from the swing of a golfer.

The striking plate **26** has a smaller aspect ratio than striking plate plates of the prior art. The aspect ratio as used herein is defined as the width, "w", of the striking plate divided by the height, "h", of the striking plate **26**, as shown in FIG. **2**A. In one embodiment, the width w is 90 millimeters and the height h is 54 millimeters giving an aspect ratio of 1.666. In conventional golf club heads, the aspect ratio is usually much greater than 1. For example, the original GREAT BIG BERTHA® driver had an aspect ratio of 1.9. The aspect ratio of the present invention preferably ranges from 1.0 to 1.7.

As shown in FIG. **7**, the internal tube **38** lies within the hollow interior **44** of the club head **20**. The internal tube is preferably composed of a metal material and has a mass ranging from 8 grams to 20 grams. The internal tube **38** is most preferably composed of stainless steel and has a mass of approximately 14 grams. The internal tubing **38** has a bore **130** to receive an insert and a shaft, not shown, therein. Such an insert is discussed in U.S. Pat. No. 6,352,482, filed on Aug. 31, 2000, for a Golf Club With Hosel Liner, which is hereby incorporated by reference in its entirety.

Referring specifically to FIG. **1**, the club head **20** has a weight member **40** disposed within the plies of pre-preg that compose the ribbon **30** of the club head **20**. Preferably, the weight member **40** is composed of three weight members **40***a*, **40***b* and **40***c*. One such weight member **40** is described in U.S. Pat. No. 6,386,990, filed on Dec. 29, 1999, and entitled A Composite Golf Club Head With An Integral Weight Strip, which is hereby incorporated by reference in its entirety. Another such method is described in U.S. Pat. No. 6,527,650 for Internal Weighting For A Composite Golf Club Head, filed on Sep. 5, 2001, and hereby incorporated by reference in its entirety. The weight member **40** has a mass ranging from 30 grams to 80 grams, more preferably 45 grams to 70 grams, and most preferably 54 grams. The weight member **40** is preferably composed of a metal material integrated into a polymer medium. The metal material is preferably selected from copper, tungsten, steel, aluminum, tin, silver, gold, platinum, or the like. A preferred metal is tungsten. The weight member **40** has a density greater than the composite material of the body **22**.

Preferably, the weight member **40** extends from approximately the heel end **34** of the striking plate **26** through the rear **36** to the toe end **32** of the striking plate **26**. However, the weight member **40** may only extend along the rear **36** of the ribbon **30**, the heel end **34** of the ribbon **30**, the toe end **32** of the ribbon **30**, or any combination thereof. Those skilled in the pertinent axt will recognize that other weighting materials may be utilized without departing from the scope and spirit of the present invention.

The placement of the weighting members **40***a–c* allows for the moment of inertia of the golf club head **20** to be optimized. A more thorough description of the optimization of the moments of inertia is disclosed in co-pending U.S. patent application Ser. No. 09/796,951, filed on Feb. 27, 2001, entitled High Moment of Inertia Composite Golf Club, and hereby incorporated by reference in its entirety. In one preferred example of the golf club head **20** of the present invention, the moment of inertia about the lxx axis through the center of gravity is approximately 2566 grams-centimeters squared ("g-cm^2"), the moment of inertia about the Iyy axis through the center of gravity is approximately 1895 g-cm^2, and the moment of inertia about the lzz axis through the center of gravity is approximately 3368 g-cm^2.

As shown in FIGS. **8**, **9**, **9**A and 9B, a return portion **100** is a transition area from a perimeter **27** of the striking plate **26** rearward towards the crown **24**. The return portion **100** has a thickness ranging from 0.100 inch to 0.200 inch to control the compliance of the striking plate **26**. The return portion **100** has an upper section **100***a*, a lower section **100***b*, a heel section **100***c*, not shown, and a toe section **100***d*, not shown. The return portion **100** also has a taper region **101**, which includes an upper tapering region **101***a*, a lower tapering region **101***b*, a heel tapering region **101***c*, not shown, and a toe tapering region **101***d*, not shown. The tapering region **101** tapers in thickness from a greater thickness nearer the striking plate portion **26** to a lesser thickness rearward toward the crown **24**.

The return portion **100** has a predetermined length which extends rearward from the perimeter **27** of the striking plate portion **26** into the crown **24**. Preferably, the distance of the return portion **100**, Dr, ranges from 0.25 inch to 2.0 inches, more preferably from 0.5 inch to 1.75 inches, and most preferably 1.5 inches. Preferably, the distance from the perimeter **27** to the beginning of the tapering region **101** of the return portion **100** ranges from 0.25 inch to 1.5 inches, and most preferably 1.0 inch.

The body **22** is manufactured from a face component **125**, which includes the striking plate portion **26** and the return portion **100**, a crown component **124** and a sole component **128**. The crown component **124** overlaps the face component **125**, as shown in FIG. **10**. The sole component **128** includes the ribbon portion **30** and the bottom portion **28***a*. The sole component **128** is attached to the crown component **124** and the face component **125**.

FIGS. **16–19** illustrate preferred pre-preg sheets for forming the composite body of the golf club head **20**. FIG. **16** illustrates a face/crown ply pre-preg sheet that is generally designated **55**. The face/crown ply **55** has a plurality of fibers **51** dispersed within a resin body **53**. The fibers **51** are preferably composed of a carbon material. Alternatively, the fibers **51** may be aramid fibers, glass fibers or the like. The resin is typically an epoxy material. The relation of the fibers **51** to the striking plate **26**, when the striking plate **26** is in a position to strike a golf ball, determines the orientation of the fibers **51**. If the fibers **51** are parallel with the ground, or in other words extending across from the toe end to the heel end, then the face/crown ply **55** has a zero degree orientation. If the fibers **51** are approximately perpendicular to the ground, as shown in FIG. **16**, or in other words extending from the crown to the sole, then the face/crown ply **55** has a ninety degrees orientation.

FIG. **17** illustrates a full face ply pre-preg sheet that is generally designated **57**. As with the face/crown ply **55**, the full face ply **57** has a plurality of fibers **51** dispersed within a resin body **53**. The fibers **51** extend from the sole **28** to the crown **24**, and thus the full face ply **57** has fibers **51** that are perpendicular to the ground when it is in a position for striking a golf ball. Therefore, the full face ply **57** of FIG. **17** has a ninety degrees orientation.

FIG. **18** illustrates a face doubler ply pre-preg sheet that is generally designated **58**. As with the face/crown ply **55**, the face doubler ply **58** has a plurality of fibers **51** dispersed within a resin body **53**. The fibers **51** extend from the sole **28** to the crown **24**, and thus the face doubler ply **58** has fibers **51** that are perpendicular to the ground when it is in a position for striking a golf ball. Therefore, the face doubler ply **58** of FIG. **18** has a ninety degrees orientation.

FIG. **19** illustrates a sole ply pre-preg sheet that is generally designated **59**. As with the face/crown ply **55**, the sole ply **59** has a plurality of fibers **51** dispersed within a resin body **53**. The fibers **51** extend at a forty-five degree angle relative to the ground when it is in a position for striking a golf ball. Therefore, the sole ply **59** of FIG. **19** has a forty-five degree orientation.

As previously stated, the preferred composite material is plies of carbon pre-peg sheets. Plies of pre-preg composite sheets are manufacby pulling strands of fiber in a parallel motion, preferably carbon, aramid or glass fiber, through a resin film and allowing the resin to partially cure or "stage". When the resin is partially staged, the resin holds the fibers together such that the fibers form a malleable sheet with all of the fibers in a specific orientation relative to an edge of the sheet. Preferred orientations are zero degrees, plus forty-five degrees, minus forty-five degrees and ninety degrees. Exemplary carbon pre-preg fiber sheets may be obtained from Newport Composites of Santa Ana, Calif., Fiberite Inc. of GreenTexas, or Hexcel Inc. of Pleasonton, Calif.

The manipulation of the thickness of the various regions of the body **22** allows the golf club head **22** to have superior durability, forgiveness and performance as compared to prior art composite golf club heads. As shown in FIGS. **12–15**, the thickness of the body **22** is focused on the striking plate portion **26**. In a most preferred example: the region designated A of the striking plate portion **26** has a thickness of approximately 0.169 inch; the region designated B, at the junction of the crown **24** and striking plate **26** has a thickness of approximately 0.188 inch; the region designated C of the bottom portion **28***a* of the sole **28** has a thickness of approximately 0.221 inch; the region designated D of the ribbon **30** and of the bottom portion **28***a* has a thickness of approximately 0.202 inch; the region designated E of the crown **24**, the bottom portion **28***a* and the ribbon **30** has a thickness of approximately 0.033 inch; and the region designated F of the crown **24** has a thickness of approximately 0.191 inch. The regions designated **Z1**, **Z2**, **Z3**, **Z4**, **Z5** and **Z6** are tapering zones where the thickness tapers rearward.

The golf club head **20** is preferably manufactured using a bladder molding process. One such process is described in U.S. Pat. No. 6,248,025, which is hereby incorporated by reference. However, those skilled in the pertinent art will recognize that other manufacturing methods may be utilized without departing from the scope and spirit of the present invention.

The coefficient of restitution of the club head **20** of the present invention under standard USGA test conditions with a given ball ranges from 0.8 to 0.9, preferably ranges from 0.81 to 0.87 and is most preferably 0.82. The coefficient of restitution (also referred to herein as COR) is determined by the following equation: $e=v_2v_1/U_1U_2$ wherein U_1 is the club head velocity prior to impact; U_2 is the golf ball velocity prior to impact which is zero; v_1 is the club head velocity just after separation of the golf ball from the striking plate of the club head; v_2 is the golf ball velocity just after separation of the golf ball from the striking plate of the club head; and e is the coefficient of restitution between the golf ball and the club striking plate.

The values of e are limited between zero and 1.0 for systems with no energy addition. The coefficient of restitution, e, for a material such as a soft clay or putty would be near zero, while for a perfectly elastic material, where no energy is lost as a result of deformation, the value of e would be 1.0. The thickness of the striking plate **26** and the orientation of the plies of pre-preg determine the coefficient of restitution of the golf club head **20**. Additionally, the thickness of the return **100** of the golf club head **20** allows for a greater deflection in the striking plate **26** which increases the coefficient of restitution of the golf club head **20**. The return **100** couples the striking plate **26** to the crown **24** which reduces the loss of energy to the striking plate **26** during impact with a golf ball. If the return **100** is too thick, the striking plate **26** is isolated and rigid, thereby reducing the coefficient of restitution. If the return **100** is too thin, failure of the striking plate **26** may occur upon impact with a golf ball.

FIGS. **20** and **21** are graphs of the sound levels of composite golf club heads, including the composite golf club head **20** of the present invention. Table One contains the calculated measurements utilized to chart the graphs. FIG. **21** is a scaled version of FIG. **20** to illustrate the differences between the composite golf club heads. The horizontal axis on each graph of FIGS. **20** and **21** represents time as time steps in increments of 0.0025 seconds. Thus, five time steps are equivalent to 0.0125 second and twenty time steps are equivalent to 0.05 seconds. The vertical axis is a measurement of the sound level of each golf club head during impact with a golf ball. The plotted sound level is the sum of the sound pressure level from the following third octave bands: 5000 Hz; 6300 Hz; 8000 Hz; 10,000 Hz; 12500 Hz; 16,000 Hz; and 20,000 Hz. These octave bands were chosen due to the equivalency in sound to metallic woods. In measuring the sound level, a microphone was placed sixty-four inches away from a teed golf ball. The microphone was also elevated approximately twelve inches from the ground. The golf ball used for the test was a TITLEIST TOUR BALATA golf ball. A golfer swung each of the golf clubs at a velocity of approximately one hundred twenty miles per hour for golf clubs with shafts of forty-five inches in length, and one hundred twenty-eight miles per hour for golf clubs with shafts of fifty inches in length. A measurement was taken at each time step interval (0.0025 seconds), and each measurement was filtered through a conventional sound meter (Larson Davis System 824) at the various frequency bands to generate a measurement of the sound at each of the particular frequency bands. These measurements were combined to obtain the combined sound level measurements in Table One for each time step interval. There was also a Doppler effect due to the movement of the golf club during impact with the golf ball as the golf ball is launched from the golf club striking plate.

Referring to FIGS. **20** and **21**, the first row of sound levels **200** represents the background noise, or the ambient noise level. The second row of sound levels **202** is representative of an ADX **100** composite golf club head available from Yonex Golf of Tokyo, Japan. The third row of sound levels **204** is representative of a Aerona **300** composite golf club head available from Yonex Golf of Tokyo Japan. The fourth row of sound levels **206** is representative of a CRANE Convex Sole composite golf club head available from Crane Golf of Tokyo, Japan. The fifth row of sound levels **208** is representative of a CRANE BACKWEIGHT composite golf club head available from Crane Golf of Tokyo, Japan. The sixth and seventh rows of sound levels represent composite golf club heads **20** according to the present invention. The CRANE BACKWEIGHT golf club will be used for comparison since it had the most relevant combined sound levels of the prior art composite golf club heads.

After the first 0.0025 seconds from initial impact, the golf club head **20** of the present invention had a combined sound level of greater than one hundred twenty decibels while the CRANE BACKWEIGHT golf club had a sound pressure level of only one hundred sixteen decibels. More interesting is the sound level comparison at later times after impact with a golf ball. At the second time step, 0.0050 seconds, wherein the golf club head **20** of the present invention had a sound level of at least one hundred nineteen decibels as compared to the CRANE BACKWEIGHT which had a combined sound level of one hundred twelve decibels. At the third time step, 0.0075 seconds, the CRANE BACKWEIGHT only had a combined sound level of one hundred five decibels while the present invention had a sound level of at least one hundred twelve decibels. At 0.04 seconds, the CRANE BACKWEIGHT only had a sound level of sixty decibels while the present invention had a sound level of at least seventy-five decibels and even as high as seventy-eight decibels. Thus, the composite golf club head **20** of the present invention has a higher sound level over a greater period of time than composite golf club heads of the prior art.

TABLE ONE

Time (sec)	Background	Yonex ADX 100	Yonex Aerona 300	Crane Convex	Crane Back Weight 1	Present Invention	Present Invention
0	37	107	105	104	100	106	99
0.0025	38	109	110	113	116	121	119
0.005	37	99	101	108	112	119	120
0.0075	37	94	95	102	105	112	112
0.01	37	89	88	96	99	107	109
0.0125	37	83	81	88	95	106	105
0.015	37	76	75	82	91	102	102
0.0175	38	71	76	77	85	96	96

TABLE ONE-continued

Time (sec)	Background	Yonex ADX 100	Yonex Aerona 300	Crane Convex	Crane Back Weight 1	Present Invention	Present Invention
0.02	38	70	77	72	84	92	95
0.0225	38	68	73	70	80	92	93
0.025	37	65	68	68	75	90	90
0.0275	39	64	67	66	75	87	87
0.03	39	62	64	65	73	84	84
0.0325	37	60	61	61	71	83	83
0.035	38	61	61	60	66	79	81
0.0375	38	60	60	59	64	76	78
0.04	37	59	59	59	61	74	76
0.0425	38	58	58	57	60	73	76
0.045	36	58	57	57	59	70	71
0.0475	37	57	58	56	59	67	71
0.05	37	56	56	57	59	67	71
0.0525	37	56	56	56	59	64	70
0.055	36	57	55	56	60	64	67

From the foregoing it is believed that those skilled in the pertinent art will recognize the meritorious advancement of this invention and will readily understand that while the present invention has been described in association with a preferred embodiment thereof, and other embodiments illustrated in the accompanying drawings, numerous changes, modifications and substitutions of equivalents may be made therein without departing from the spirit and scope of this invention which is intended to be unlimited by the foregoing except as may appear in the following appended claims. Therefore, the embodiments of the invention in which an exclusive property or privilege is claimed are defined in the following appended claims.

We claim as our invention:

1. A composite golf club head comprising:

a face component composed of a plurality of pre-preg plies having fibers, the plurality of pre-preg plies ranging from 20 to 70 plies, the face component having a striking plate portion and a return portion, the striking plate portion having a thickness in the range of 0.010 inch to 0.250 inch, and the return portion tapering in thickness rearward from a perimeter of the striking plate portion;

a crown composed of a plurality of pre-preg plies ranging from 3 to 20 plies, the crown attached to the face component;

a sole composed of a plurality of pre-preg plies ranging from 3 to 20 plies, the sole having a ribbon portion and a bottom portion the bottom portion of the sole attached to the return portion of the face component and the ribbon portion of the sole attached to the crown;

a weighting member disposed within the plies of pre-preg of the ribbon portion of the sole; and

a sole plate attached to the external surface of the bottom portion of the sole, the sole plate composed of a metal material;

wherein the golf club head has a combined sound level greater than one hundred seventeen decibels during impact with a golf ball at approximately 120 miles per hour to approximately 128 miles per hour, when measured from a distance of sixty-four inches from the impact point.

2. A composite golf chub head comprising:

a body composed of a plurality of plies of pre-preg, the body having a hollow interior defined by a striking plate, a crown, a sole, and a ribbon, all of which are composed of plies of pre-preg material, the body having a volume of 275 cubic centimeters to 450 cubic centimeters, the body weighing under 120 grams;

a weight member disposed within the plies of pre-preg of the ribbon, the weight member weighing from 35 grams to 75 grams;

a sole plate attached to an external surface of the sole of the body, the sole plate composed of a metal material and weighing from 5 grams to 20 grams; and

an internal tube disposed within the hollow interior of the body, the internal tube composed of a metal material;

wherein the golf club head has a combined sound level greater than one hundred seventeen decibels after 0.0025 seconds from initial impact with a golf ball at approximately 120 miles per hour to approximately 128 miles per hour, when measured from a distance of sixty-four inches from the impact point.

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